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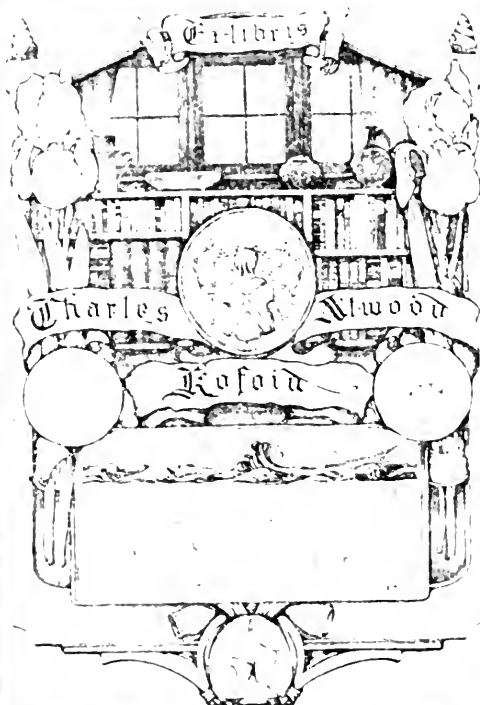
PRE-GLACIAL MAN
AND
GEOLOGICAL CHRONOLOGY

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J. SCOTT MOORE

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PRE-GLACIAL MAN.

Thomas Kelly.
Dec. 1903.

PRE-GLACIAL MAN,

AND

GEOLOGICAL CHRONOLOGY;

FOR THREE MILLIONS OF YEARS BEFORE THE YEAR 1800, A.D.

BY J. SCOTT MOORE.

SECOND EDITION.

WITH ADDENDA AND DIAGRAM

OF

THE ECCENTRICITY OF THE EARTH'S ORBIT

FOR FOUR MILLIONS OF YEARS.

DUBLIN:

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1869.

Geol

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PREFACE TO SECOND EDITION.

SINCE the First Edition was published, tables of the eccentricity of the earth's orbit, for two millions of years farther back, have been received.

These have rendered necessary a Second Edition of "Pre-Glacial Man," with Addenda.

The diagram for one million of years has been withdrawn, and one embracing four millions of years upon one sheet has been substituted.

P R E F A C E .

IF it be difficult to assign dates to the commencement of ancient monarchies and their early dynasties, after the lapse of a few thousand years, what must it be to attempt to ascertain the ages of the several formations of the crust of the earth, and the varied fauna and flora, for several millions of years !

Improbable as it appears, a time may arrive at which those dates may be established with greater accuracy (relatively) than those of many of the monarchies which have flourished and decayed since the days of Adam.

Great strides have, of late, been made in geological chronology. Croll's tables have been calculated at the instance of Sir Charles Lyell ; and from them the dates of the glacial epochs, which have occurred within the last million of years, have been approximately ascertained.

Many difficulties must have been encountered, and much labour undergone, by Sir Charles and other great geologists, in tracing the remains of extinct animals and of man, through the several strata in which they have been found. The works of man have been followed back through formations

long prior to the Scripture date of the creation of Adam ; and the remains of animals (then of extinct races, but belonging to existing genera) have been found in pliocene and early post-pliocene deposits, which were prior to the last great glacial epoch. Sir Charles gives us hopes of discovering hereafter evidences of the presence of man in pliocene times.

On the diagram for one million of years, constructed from Croll's tables, placed at the end of this book, I have attempted to give dates for the several formations, from the time of the lower miocene to the present period. This is only a rough attempt—an approximation which will require to be rectified, or confirmed, on farther investigation, by competent parties, their attention being drawn to the subject.

There are several facts to show that palæolithic man was cotemporaneous with the extinct placental animals of pre-glacial times ; and in the diagram I have placed him so, accordingly. At the same time, there are other circumstances in favour of his post-glacial origin—such as finding his remains in post-glacial deposits ; but as those remains may have been torn out of their original beds, either by icebergs, by glaciers, or by floods, and deposited in the more recent formations, it still remains an open question, awaiting further investigation and future discoveries.

If, ultimately, it be found that palæolithic man

was of post-glacial formation, his first appearance upon the earth would have been within 50,000 years from the present time. If it be proved that he existed along with the extinct pre-glacial animals, it would carry his time back to that of from 300,000 to 400,000 years. Once we pass the boundary of Adam's creation (nearly 6,000 years), we need not hesitate to extend the time of man back so far as we can find his traces, without any further danger of conflicting with the Mosaic account.

If the sixth day of the Hexaëmeron embraced the eocene period, as I think has been substantially shown, it extended to more than the million of years set forth in the diagram ; and within that period the earliest trace of man could be comprehended, in perfect accordance with the Mosaic record.

J. S. M.

[Parts of some of the following Papers were read at evening meetings of the Royal Geological Society of Ireland.]

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PRE-GLACIAL MAN,

ETC.

CHAPTER I.

“The earth was without form, and void.”

THE discoveries in geology, for the last half century, have forced the conclusion, that the six days in the Mosaic account of the creation were six long cons, each perhaps embracing many thousands, if not millions, of years. This view is not incompatible with the Word of God, wherein it is stated that “in His sight a thousand years is as one day,” to whom (having existed from all eternity) a million of years may pass “as a click of the clock.”

A frequent mode of revelation of His will to man, was by visions during sleep.

Assume, therefore, that the progress of finishing the earth, from the time it was without form, and void, to the time of its final peopling, was revealed to Moses in *six* visions, and that his account of the creation merely describes the state in which he saw the earth in those six successive visions, and his history of the Hexaëmeron is perfect.

In this view, so far from his account being inconsistent with geology, it is, by the testimony of the rocks, so completely confirmed, that it is impos-

sible this history could have been written by any man unless he had been inspired by the Almighty, so short, so succinet, so true, so graphic, and so minute an account of the progress and successive creation of animal life, from the time of the "moving of the Spirit of God on the face of the waters," and of that sublime command, "Let there be light," up to the final act of the formation of man, unless he had been divinely instructed. That this inspiration was by vision, is supported by the very wording of his description: It was evening, for darkness was upon the face of the deep, "and evening was and morning was time one" (such is the literal translation); so that the first vision was between the evening and next morning.

It is evident that the reference of Moses to the "evening and morning" being one day, had only reference to the time elapsing between each of his own visions, and not to a shifting measure of time, which varies from twelve hours for the day to six months, according to latitude.

The fossil remains discovered by geologists in the rock, completely bear out and verify the several successive creations in the order of herb, fish, reptiles, birds, beasts, cattle, and creeping things of the earth, and lastly of man.

Moses, when he described what he saw in his six visions, was unaware that for several thousand yards beneath his feet lay a confirmation of the mighty truths he was then detailing with such conciseness and simplicity; and it is only within the present century that this evidence (graven by the finger of God in the heart of the deepest rocks) has been

appreciated by man. The sequence described by Moses is perfect.

Unable to contradict geological facts, yet unwilling to expand the six days of the Hexaëmeron, some have argued, that as nothing is impossible with the Almighty, He might have created the rocks, with the resemblance of fossil remains therein enclosed, within the period of six natural days. This course of argument is unworthy of a reply. Others have contended that the earth, with all its rocks and fossils, was created before the Hexaëmeron of Moses commenced, and that the six days of creation were six natural days of twenty-four hours each.

Mr. Gresswell, in his elaborate work of "The Three Witnesses ; or, the Threefold Cord," enlarges upon a suggestion made by Doctor Chalmers ; and he comes to the conclusion, that there was an interval of indefinite extent between the 1st and 2nd verses of the 1st chapter of Genesis, which, in the Scriptural account of the creation, had been passed over in silence ; that, on the eve of the Mosaic Hexaëmeron, the earth itself was in being, revolving round the sun ; that the moon was also in being, and everything going on as to this day, save that the earth was destitute of light, of life, of an atmosphere—covered with water, and shrouded in darkness. He contended, moreover, that the inspired chronology of Scripture reckons the duration of created existences, as measured by time, perpetually in a succession of periods or eons ; that it authorizes us to infer there has been a series of such eons, greater or less in number, before the Mosaic cosmogony, and that there will be a similar series of eons, destined to go on for ever,

after the Mosaic creation, when everything included in it shall have fulfilled its purpose, and consequently come to an end ; that, with respect to the past history of our earth, no inconsistency, no contradiction was ever to have been apprehended between the testimony of Scripture and these discoveries, simply because Scripture goes no further back in the history of our planet than the Mosaic Hexaëmeron, B.C. 4004. The era of geological discovery, he asserts, is entirely beyond this epoch in its history.

To prove that the earth, in its present state, was created or reconstructed at the time detailed in the Mosaic account, he shows that the mean noctidiurnal and annual time, traced back from the present day, under their proper Julian style (that is, the noctidiurnal from a given *feria prima*), the annual tropical from a given mean vernal equinox, the annual sidereal from a given conjunction of the sun with the stars Beta and Zeta Tauri, the annual anomalistic from a given conjunction of the mean sun with the apogee of the solar orbit, and all calculated for the meridian of ancient Jerusalem, are found to meet together in one year of the era before Christ, 4004, and on the 25th of April, at midnight ; and mean natural menstrual time is traced back, in like manner, to April 25th and May 2nd, B.C. 4004.

He admits that all these requisites may have passed back beyond that period ; but that, if so, we must reckon back from thence 516,000 years, to arrive at the time when they could have been all setting out together at the point of midnight last before. He argues that the decursus of the present state of things which enters into our state, known as the

efflux of time, commenced with the first day of the Mosaic account, and has so continued to the present day.

The argument of Mr. Gresswell is to the effect, that the date of 4004 years before Christ commenced at the 2nd verse of the 1st chapter of Genesis—"and the world was without form, and void;" that it had previously existed for thousands of years, during which time the world of the geologists had been gradually constructed, from the earliest primitive rocks down to the tertiary and recent deposits; that then, in six natural days, the Almighty commenced anew, and restored all created existences. But will naturalists and geologists agree with this view? Do they find any such decided break or cataclysm, embracing all creation, of fish, flesh, and fowl, trees and vegetation, to have occurred at the termination of the tertiary period? or do they not rather find irrefutable evidence of uninterrupted continuance of life at that period, in every department of nature? On some part of the globe there had been some races dropping off and becoming extinct occasionally during the geological periods, as well at sea as on land; but, through the whole, there had been others continued, so as to form an unbroken connexion, from the time Laurentian and Cambrian rocks were deposited, down to the present day. Would not the "without form and void" state of the earth have been more applicable to the azoic than the quaternary period?

If, instead of commencing a decursus of the efflux of time with the first day of the Hexaëmeron, as Mr. Gresswell does, we begin with the seventh, or im-

mediately after the creation of Adam, on the evening of the sixth day, and adopt Mr. Gresswell's epoch of 516,000 years as the previous preceding period of all his several conjunctions ; if we look on the sixth day of the Hexaëmeron to have embraced the tertiary and quaternary ages,—we have apparently an eon of sufficient duration to meet the geological requirements of the eainozoic cycle.

If we trace back five similar epochs of 516,000 years each (allowing each Mosaical day to consist of so many years), we have eons of ample length, but still not sufficient to allow of the formation, according to geological process, of all the wonders revealed to us in the records of the rocks. It will appear in the sequel, that the sixth day of itself comprehended more than two cycles of the above extended duration, and most likely embraced a third.

Professor Sir William Thomson has calculated the probable age of the crust of the earth to be about 98,000,000 of years, which must comprehend the geological history of our globe.*

According to the account of Moses, it was the fourth day, before the sun, moon, and stars were seen by him in the vision. It may be inferred from this, that, on the fourth Mosaical day, the sun, moon, and stars were made visible to the earth, and that, previously, they had been obscured by clouds, fogs, and gaseous vapours.

From astronomy we learn, that the stars composing some of the nebulae are so distant, that light, travelling at its usual velocity, would not have

* *Phil. Mag.* for 1863.

reached this earth from that distant point in less than 700,000 years; and that, when we now look on those nebulae, we do not see them as they are at the present day, but as they were 700,000 years ago.*

As to our sun, if we adopt the nebular hypothesis of the compression of his atmosphere, and of his casting off the earth and all the other planets, from time to time, as his atmosphere became more and more compressed, we have measures of time, or cons, stretching so far back into eternity as to be incomprehensible to man. When the planet Neptune was thrown off (long before this earth had existence), the atmosphere of the sun must have extended so far as Neptune. What, then, must have been the time required to have consolidated its atmosphere from the outer borders of the orbit of Neptune, through its gradual diminution and condensation, until it had cast off Uranus, Saturn, and all the other planets, and only exhausting itself when it had shot forth that brilliant sparklet Mercury?

From Professor Houghton's fourth lecture on geology (Appendix C), we learn that it required 350,000,000 of years for our earth to cool from 2000° to 200° centigrade; that the time of cooling from 212° Fahrenheit (the temperature of boiling water) to 122° Fahrenheit, at which organic life became possible, was 1,018,000,000 of years; and that it would require 1,280,000,000 of years to cool from 122° to 77° Fahrenheit.

* According to Guillemin, rays of light from nebulae so far off as the seventy-fifth clusters of Messier's catalogue, must (to reach us) have left such nebulae more than 700,000 years ago.

Who is there, on examining these inconceivable periods, would remain of opinion that the Almighty, the Great Creator of all the thousands of suns we see, and of the infinite numbers which are beyond our ken—whose ways and works have been from everlasting—commenced on a Monday morning, nearly 6,000 years ago, to make this earth, and finished His work upon the following Saturday night? Let the six days of Moses be treated as six long eons, extending back towards infinity, and all will be in simple harmony and grandeur—a creation becoming gradually perfect through countless ages, worthy of the great and everlasting Being we adore.

Having once viewed the Mosaic account of the creation in the light of visions, exhibiting six distinct scenes, selected from different cycles, let us again turn to the fourth lecture of Professor Houghton on geology, and observe his remarks on the gradual production of animals on the face of the earth, and then proceed to man.

In the 94th page he says: "If we confine ourselves to the broad distinctions that exist among the various races of animals (and, indeed, we may say of plants), there is no fact more certain in the history of the globe, than that, as the world grew older, a greater variety of species were introduced upon its surface; and those species and creatures that were so introduced became higher and higher in their organization, until the Creator was pleased to crown the whole by the introduction of man himself." The learned professor expresses the supposition, that as the conditions of life upon the globe changed and improved, so as to render possible the

existence of more highly organized groups of creatures, those creatures were placed there by the will of their Creator.

Taking a cursory glance over the various tribes of man, some in their native forest, others in their populous cities, some in their huts of ice in the polar regions, others again under the burning sun of the torrid zone, black, white, red, copper-coloured, of every variety, all differing in intellect, in habits, in language, in the shape of the skulls, in the framework of the bodies, length and strength of the bones, but each and all adapted to the climate in which they were respectively planted, and to the circumstances in which, by nature, they are surrounded, does not a strong feeling arise that they (like those of the brute creation of various degrees of organization, some higher, some lower) have been placed from time to time upon the earth, as it was prepared to receive them? We ask ourselves, can all these varieties be derived from the same pair of ancestors? Are we not at liberty to infer that there were other races of man on the face of the earth prior to and co-existent with Adam?

Mr. Page, in his "Geology for General Readers," has the following:—"In investigating the antiquity of man, we are dealing with a question of natural history, and are bound by the same method of research as if we were treating of the history of the mammoth or mastodon. Our business, as geologists, is to examine the rock formations composing the earth's crust, to note their imbedded organisms, and to fix their relative antiquities. Wherever the remains of man or his works occur, there, we presume, has

been his presence ; and, though we cannot assign any definite date to the time of such occurrence, we are at all events entitled (judging from all the correlative circumstances) to say that it took place 6,000, 10,000, or 20,000 years ago."

It was on the sixth day that God made the beast of the earth after his kind, and cattle after their kind ; and on the same day He made man, *male and female*. If it can be shown that beasts and cattle existed thousands of years before Adam, that would be conclusive as to the great extent of a Mosaical day.

CHAPTER II.

THE HEXAËMERON.

Revelation.

UNTIL recently, Adam had been deemed the first of mankind. Taking it for granted that the Word of God cannot be contradicted by His works, we should examine the Scripture carefully to ascertain whether Adam is so decidedly stated to have been *the first* created man, that all further inquiry on the subject is closed ; or whether in fact the traditional part of the Mosaic account of the creation of Adam was only intended to give the history of one particular family, through which *the descent of our Saviour* was to be traced.

The fact that the Mosaic days or times of the creation were six successive periods of long duration, can no longer be resisted. Hugh Miller, in his "Testimony of the Rocks," gives a most graphic view of the Mosaic visions.* In page 168, he says "that the prophetic vision of the creation consisted only of six single representative scenes, embracing each but a point of time ; that it was a diorama, over whose shifting pictures the curtain rose and fell six times in succession—once during the azoic period ; once during the earlier or middle palæozoic ; once during the carboniferous ; once during the

* See also M'Causland's "Sermons in Stones."

permian or triassic ; once during the oolitic ; and, finally, once during the tertiary period."

Looking upon each day of the Hexaëmeron as an extended cycle of time, we see, in the 1st chapter of Genesis, that the Almighty had created man, male and female, had ordained them to *be fruitful and multiply*, had given them dominion over everything that moveth on the earth, and had provided them with food, without any restriction.

We are not told whether the male and female were two or two hundred ; whether there were several centres of creation of man or only one. There may have been any indefinite number, without contradiction to the Mosaical account.

The original Hebrew word in the Bible signifying man, denotes the human race—man in general—mankind.

And evening was, and morning was, The sixth day.

Had the *sixth day* been translated the sixth era, or epoch, or cycle of time, as it might have been literally, any of these wordings would have more correctly conveyed to our minds the comprehensive views exhibited to Moses, than the contracted meaning we affix to our conventional word DAY.

Moses thus closes his revealed account of the creation of the earth, and the fitting it for the reception of man :—"These are the generations of the heavens and of the earth, when they were created, in *the day* that the Lord God made the earth and the heavens." He calls *the six days* of the Hexaëmeron "*the day*," showing plainly that his days comprised extended cycles of time. He concludes in the next verse with an observation.

“The Lord God had not caused it to rain on the earth, and there was not a man to till the ground.” This remark, followed immediately by the description of the creation of Adam, in the 7th verse, has been held to prove that *our Adam* was the first, and that man had no existence on the face of the earth before his time.

On examining the first part of the 5th verse, it will be found not to refer to the sixth day, nor to the state of the earth immediately previous to the creation of Adam, but to a period long anterior—a time comprehended within an early part of the third day of the Hexaëmeron, after the dry land appeared, before the plants and herbs of the field had grown, and at a time when, instead of rain, a mist arose from the earth, and watered the whole face of the ground—a time at which a dense mass of thick darkness enveloped the earth, ere the steaming gases had been broken up into clouds, before the sun became visible in the heavens, before there was an atmosphere resembling that of the present day.

Moses was not a geologist. The science was then utterly unknown. The glorious “medals of creation” lay buried in the rocks; there they remained, unheeded, unsuspected, and so continued for nearly 6,000 years, before they attracted the attention of man.

And yet, with what accuracy is the order of creation described by Moses.

Had he placed the creation of man and the beasts of the field on the fourth day, the tree yielding fruit on the fifth day, or the winged fowl on the sixth day; had he in any way transposed the order of

creation from what he has detailed, his account would have been at variance with the sequence of the works of the Creator. The facts disclosed by geology would have confronted him, and the Hexaëmeron would have appeared but as the relation of six fleeting dreams.

After a lapse of nearly 4,000 years since Moses wrote, geology has been cultivated as a science, the works of the Almighty have been carefully examined, the course of creation traced in the rocks ; and the Mosaic account stands forth before the world, in all its simplicity of truth and grandeur, the most wonderful chapter that ever was penned.

If all the great geologists of the present day, men who have devoted their lives to geological science, were collected together—if each was given a sheet of paper, and requested to describe the order of creation of the earth from the time it was “without form, and void,” upon that sheet, could any of them convey to the human mind in language so simple, yet so majestic, so accurate and truthful a detail of the great evolutions of the creation as that of Moses ? He merely detailed what he saw in six several glimpses, and was probably utterly ignorant of the depth, extent, and magnitude of the great and comprehensive truths he had announced.

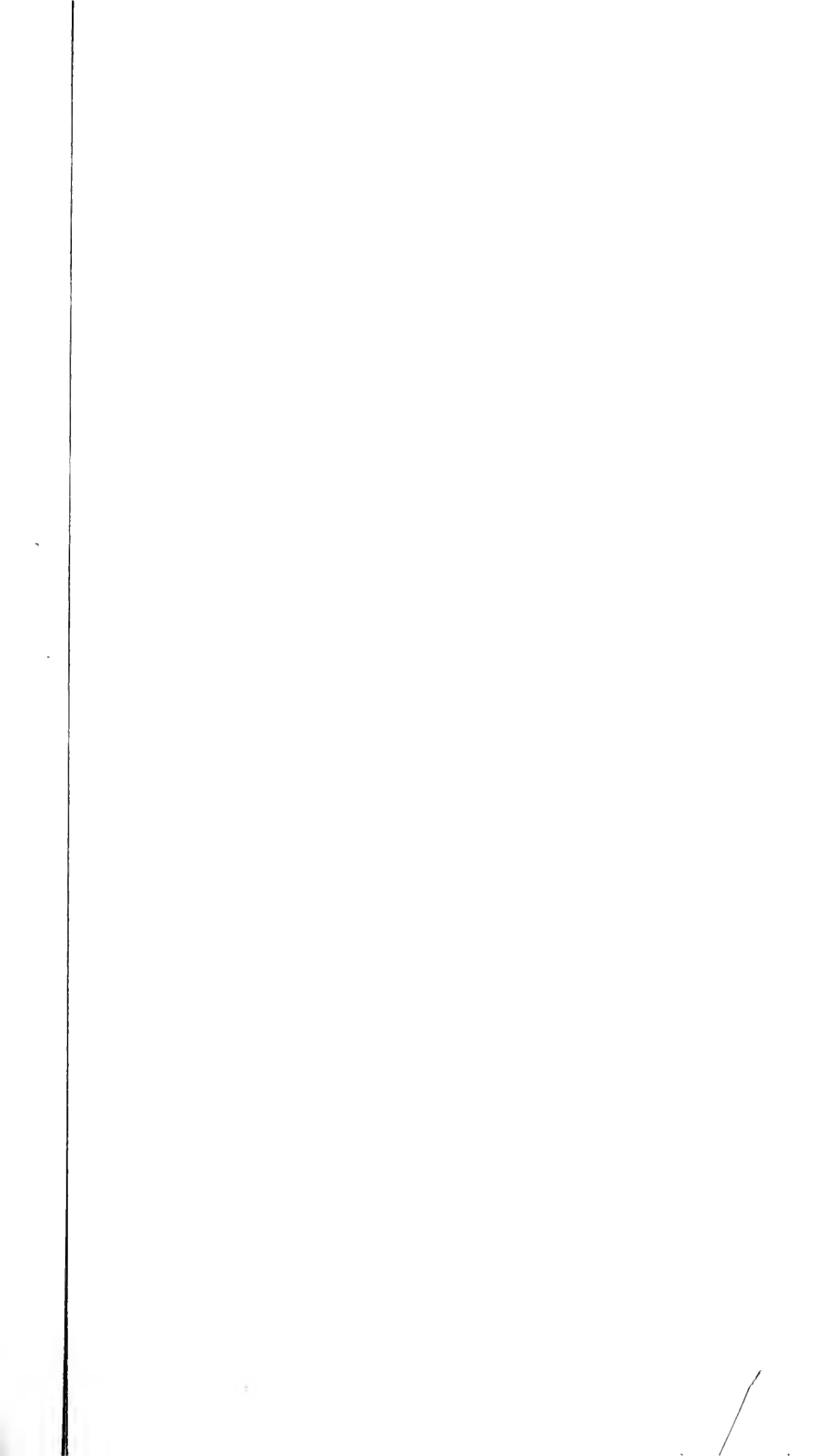
Mr. McCausland, in his “Adam and the Adamites,” has explained most satisfactorily the distinction between the Hebrew words “Adam” and “Ish ;” the former denoting the highest race of mankind, and the latter including the other and lower races. He has shown, by an amended translation of the early chapters of the book of Genesis, which will be

found in the Appendix of the second edition of his work, that the distinction between these words has not been sufficiently observed ; and his conclusion is, that there were several creations of human races, at different centres of creation, before that of Adam, who, we are told, was created in the image of God. It was natural and consistent that the entry into life of the highest and most perfect specimen of humanity, should have been the subject of the divine revelation, more especially as Adam and his descendants, the Adamites, have been the highest civilized and civilizing race of mankind, and without whom there would have been no knowledge of the true God on the face of the earth. There are statements in the early chapters of Genesis that are more consistent with the theory of pre-existing races of mankind, than with the interpretation that Adam was the first created of human beings. We shall return to this part of the subject in a future chapter.

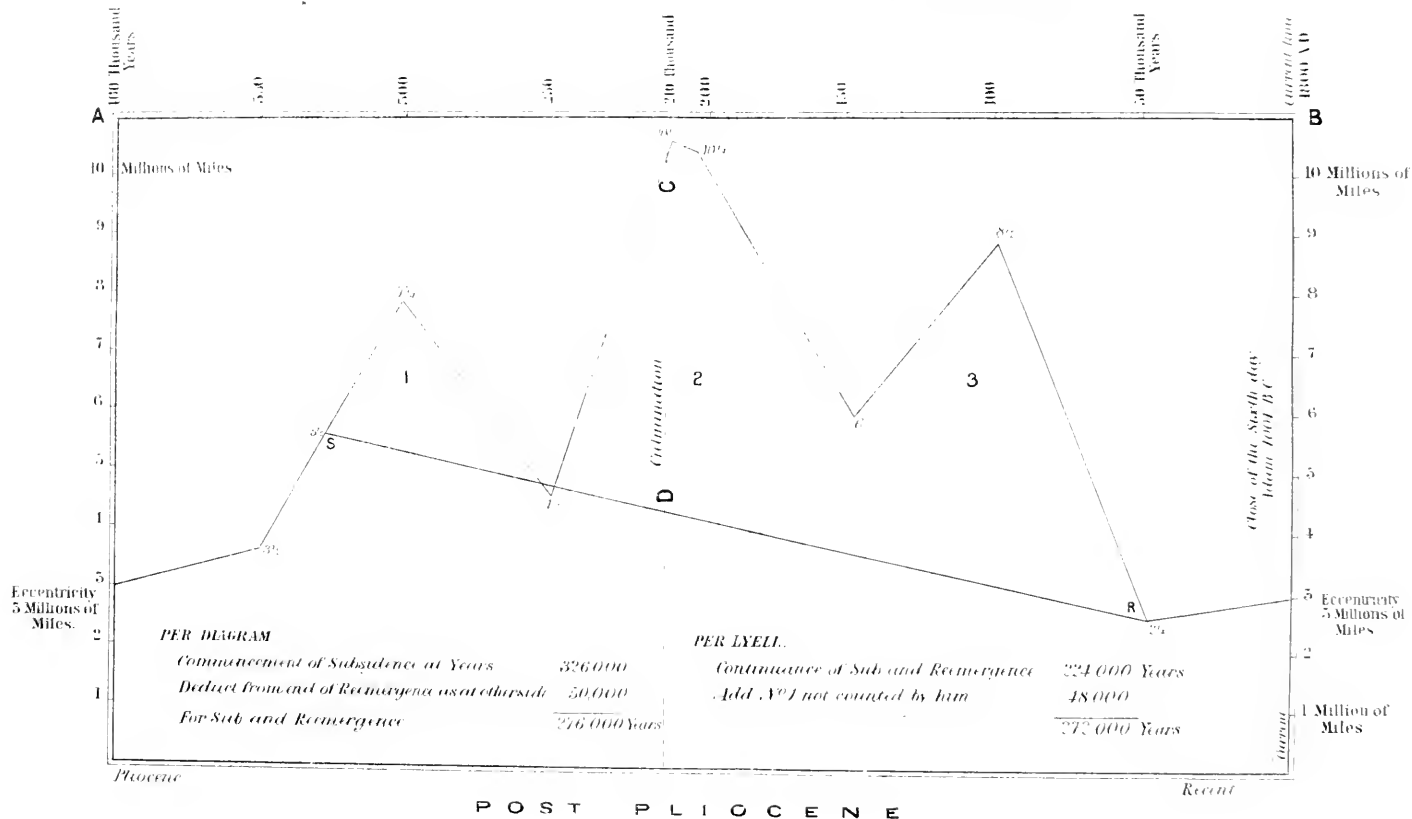
The history of Adam being placed in the garden, his fall, and the events which occurred from thence to the time of Moses, are altogether outside the revealed account. After the generations of the heavens and the earth were declared by Moses, and the description of their creation wound up and closed, “in *the day* that the Lord made the heavens and the earth,” the revelation ended; we could have known nothing of creation or of the history of the formation of the earth but for that revelation. Adam could not have disclosed the secret. It pleased the Almighty to give Moses a partial insight into a small portion of the wondrous work He had wrought

in the preparation of the earth for the reception of man.

Upon the appearance of Adam on the earth, the necessity for farther revelation with respect to the creation ceased. Adam was able to narrate the events of his life to his children, and thenceforth his history and that of his descendants was most likely carried down by tradition.



LATTER PART OF THE SIXTH DAY OF THE HEXAEMERON.



CHAPTER III.

GEOLOGICAL CHRONOLOGY.

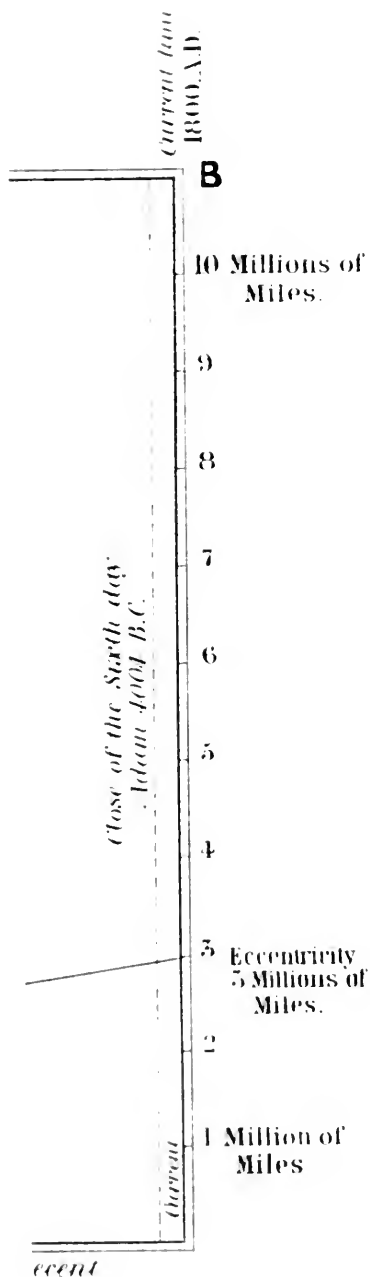
The Post-Pliocene Glacial Epoch.

IN examining the crust of the earth, the earliest traces of the cattle and beasts of the field (creations of the sixth day) appear to have been during the pliocene and early part of the post-pliocene period. The mammoth or woolly elephant, with other animals, inhabited the most northern parts of Europe and Asia.

In the south of Europe, the rhinoceros tichorhinus, hippopotamus major, hyæna, cave bear, &c., were in great abundance.

Thousands of years must have elapsed ere those countries became so fully stocked with those animals, as they must have been, judging from the multiplicity of remains which have been discovered. Tilieson states, that thousands of fossil tusks of the mammoth have been collected in Siberia, and sold in great plenty; and, according to his belief, their bones, still left in Northern Russia, must greatly exceed in number those of all the elephants now living on the globe.

Those animals are now referred to as *the extinct*; their races have perished from off the face of the earth. During the early ages of their existence, the climate of the northern part of Europe was mild.



CHAPTER III.

GEOLOGICAL CHRONOLOGY.

The Post-Pliocene Glacial Epoch.

IN examining the crust of the earth, the earliest traces of the cattle and beasts of the field (creations of the sixth day) appear to have been during the pliocene and early part of the post-pliocene period. The mammoth or woolly elephant, with other animals, inhabited the most northern parts of Europe and Asia.

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Those animals are now referred to as *the extinct*; their races have perished from off the face of the earth. During the early ages of their existence, the climate of the northern part of Europe was mild.

At that time England was joined to France, no British Channel existed, and there was a free passage for the wild animals of Europe and Asia to traverse to England.

Before the post-pliocene glacial period, a forest of aged growth extended for forty miles along the English coast, and is supposed to have continued to that of the opposite continent.

The rhinoceros and hippopotamus wallowed in its sedgy swamps; under its shady branches the hyæna spelæa, the cave bear, and the felis spelæa, were pursued and combated by man. The climate of England was then mild, genial, and inviting to those animals; they invaded the country, and adopted it as their own.

But, with the march of time, the climate changed; the eccentricity of the orbit of the earth became more prolonged; colder and colder grew the chilly air; until, at length, the whole northern hemisphere, so far as the thirty-fifth degree of latitude, became buried in snow and ice.

The ascertainment of the time of the glacial period presented great difficulties to the geologist. It was not until lately that any probable approximation towards it was made.

Sir Charles Lyell was anxious to determine the dates of those variations in the eccentricity of the earth's orbit, which would throw light upon the period.

1st. When the cold first came on.

2nd. When it reached its height.

3rd. And when it was succeeded by a great thaw, which reduced the ice to its present limits.

He obtained, through the Astronomer Royal, the assistance of Mr. Stone, of the Greenwich Observatory. Mr. Stone, by the use of Leverrier's formula, determined that the last high eccentricity occurred 210,000 years ago.

His calculations were followed up by Mr. Croll, who computed the changes of eccentricity for a million of years preceding A.D. 1800 ; other deductions were made by Mr. John Carrick Moore; and the whole are presented in a table in Lyell's "Principles of Geology," page 293 (10th edition).

Lyell had made calculations respecting the submergence and re-emergence of the crust of the earth in Europe, which (as an approximation), he suggested, may have occupied about 224,000 years.*

On comparing his calculations with the results brought out from a diagram prepared from Croll's tables, there appears a discrepancy; but, on allowing for one period of glaciation not taken into Lyell's account, there is such concordance that I may venture to submit the question for examination.

Before entering further on the subject, I must lay a foundation for the superstructure, and give a few postulates sustainable by proof.

1st. It is 400,000 years (with one exception) since the eccentricity of the orbit of the earth was equivalent to that of the present time, that is, 3,000,000 miles.

2nd. That from that period (not taking into account the minor oscillations) the eccentricity gradually increased, until it reached its maximum of

* "Antiquity of Man," page 285.

10,500,000 miles, which occurred 210,000 years ago.

3rd. That the intensity of the cold gradually increased as the eccentricity increased, until the time of the culmination of the eccentricity.

4th. That after such culmination the cold became gradually less rigorous as the eccentricity diminished, and again increased as the eccentricity increased.

5th. That the eccentricity of the earth's orbit was the cause of that period called the glacial.

Lyell's or Croll's tables, before referred to, will sustain these five propositions.

6th. That the intense cold of the glacial period was the cause of the submergence of portions of the crust of the earth of the northern hemisphere, and its abatement the cause of the re-emergence.

7th. That the subsidence of the land being caused by the intense cold of the glacial epoch, those two were concurrent, and the time of the culmination of the one was the period of the culmination of the other.

8th. That the time of the continuance of the submergence and re-emergence, according to Lyell, occupied 224,000 years.

9th. That the intensity of the post-pliocene glacial period having happened 210,000 years ago, and the culmination of the submergence at the same time, we must presume the submergence abated rateably with the cession of the intense cold of that glacial epoch, and that the land continued gradually to rise, *pari passu*, with the relaxation of the extreme rigour of the atmosphere.

10th. That if we deduct the years of the re-emer-

gence, being 112,000 (or half the 224,000, according to Lyell), from 210,000, the time from the height of the glacial period to the year 1800, we have an era of 98,000 years, or (according to the accompanying diagram, based upon Lyell's tables) 50,000 years since the close of the post-pliocene period—since the completion of the days of the last great re-emergence and beginning of the recent period.

The discrepancies between the 98,000 years and the 50,000 are reconcilable, as will appear hereafter.

These figures show but a rough approximation; no hard line can be fixed in any of the above calculations; the periods must all have been gradually blended together with a libration either on one side or the other, to the extent of some thousand years—for instance, we have as yet remains of the last great cycle of cold, also partial subsidences and re-emergences.

As to authority for No. 6, that the submergence was caused by the cold of the glacial period,

Lyell does not lay it down in so many distinct words, but he leads you to that inference.

In page 286 of his "Antiquity of Man," he says: "Little progress has yet been made in divining the most probable causes of these great movements of the earth's crust; yet what little we know of the state of the interior, leads us to expect that the gradual expansion or contraction of large portions of the solid crust, may be the *result of fluctuations in the temperature.*"

He further says: "It is ascertained that solid rocks, such as granite and sandstone, expand and contract annually, even under such a moderate tempe-

rature as that of a Canadian winter and summer ;” and again, “ that, according to *Déville*, the contraction of granite in passing from a melted or plastic condition, would be more than ten per cent.”

The late Sir William Hamilton found that the contraction of the earth’s surface during the winter, and expansion during the summer, even in this mild climate, had a sensible effect upon his astronomical instruments.

To show that the submergence and the extreme glacial cold went *pari passu* together, I would quote from Professor Nilsson’s “ Stone Age.” He states that shell banks in the north-western parts of Sweden and Norway are frequently met with, to the height of several hundred feet ; “ that the highest shell banks on the mountain sides belong to an icy climate ; that their fellow-species now live in the cold zone of Spitzbergen ; that, as we descend the mountain, the shell banks lower down are composed of species which belong to more temperate waters ; and finally, lower again, we meet with those that still live on our coasts.”* Here we find the greatest depression of the land marked by the existence of arctic shells ; that, as the climate relaxed, and the land re-emerged, the character of the shells became altered to those of more temperate waters, until, at the lowest parts, they became assimilated to those at present inhabiting the Norwegian coasts.

Refer for a moment to diagram 1, at the beginning of the book, for the more distinct elucidation of the subject.

The eccentricity of the earth’s orbit at the present time is 3,000,000 miles.

* Page 247.

400,000 years ago the eccentricity of its orbit was equal to what it is at present—3,000,000 miles.

Let the line A B represent 400,000 years.

Let the line C D represent the centre or culminating point of the glacial period and of the submergence 210,000 years ago.

The irregular lines from 3 to $10\frac{1}{2}$ on the left side, and back again to 3 on the right side, represent the movements of the eccentricity of the orbit of the earth during those 400,000 years. There were minor oscillations of the eccentricity, caused by the precession of the equinoxes, but we need not take them into account at present.

The line S to R represents the period of subsidence and re-emergence of parts of the crust of the earth, comprehending 276,000 years.

When the eccentricity of the earth's orbit was at 10,500,000 miles, the intensity of the winter's cold was, according to Denison, 73 degrees below the mean winter cold of the present day.*

What was the effect of this intense cold? We have already stated, on Lyell's authority, that granite, and sandstone, and other rocks, contract with the cold, and expand with heat.

The effect, therefore, of the intense cold of the glacial period, would have been to contract the rocks.

What would have been the effect of such contraction?

The crust of the earth would consequently subside, and the waters of the sea flow over the more depressed portions, to the extent of from one to two

* Denison's "Astronomy," page 33.

thousand feet, according to the nature of the underlying rock and its contractile qualities.

This was the period of the submergence of geologists.

As the cold increased, the subsidence increased ; as the cold diminished, re-emergence took place ; and they moved up and down *pari passu* together.

I have already stated that Lyell computed the submergence and re-emergence to have occupied 224,000 years. He only took into account two periods of submergence—"continental periods" he calls them.

It is manifest from the table of eccentricity of the earth's orbit, and the consequent variations in the intensity of cold, that there were three periods of submergence.

Look to the post-pliocene diagram (figures, 1, 2, 3).

It is not likely that during those periods (*viz.*, between the line S R of 300,000 years) there was any continental period whatever. If there were, it must have been when the eccentricity fell to 2,500,000 miles. The reason for doubting there being one at that time, is that, during the previous 250,000 years, the cold had got so far in advance, that the summer's sun and the rain were unequal to the melting of one-eighth part of the winter's snows.*

Ice, therefore, had annually greatly accumulated, to the extent of 2,000 to 5,000 feet in thickness, in the north and south polar lands.†

* Lyell's "Principles of Geology," vol. i. page 271 ; Croll's "Memoir of 1864."

† Lyell's "Principles of Geology," vol. i. page 289.

The comparative short period between the time of the eccentricity of the earth's orbit falling to 2,500,000 and returning to 3,000,000 miles (as it is at the present day), would not have so raised the previously cold temperature as to cause a re-emergence to the extent of 400 feet (the depth of the British Channel, or 250 to 300 feet at the Straits of Dover).*

Returning to Lyell's calculation of 224,000 years for the submergence and re-emergence, and adding thereto, for No. 1 omitted, a period of 48,000 years (that being the same amount allowed by Lyell for his second submergence and re-emergence), it gives an extent of time of 272,000 years.† By the diagram it would be 276,000 years.

Professor Ramsay shows three successive glacial periods; and Mr. Morlet discovered, in the Gorge of Dranse, near Thonon, three glacial formations, the last requiring 100,000 years.‡ Taking the line S to R for the submergence and re-emergence across the diagram from $5\frac{1}{2}$ to $2\frac{1}{4}$, or, in other words, from the time at which the eccentricity was 5,500,000 to the time it had fallen to 2,250,000 miles, it gives 276,000 years.

Lyell's calculations were made on the assumption that the subsidence and re-emergence took place at the rate of $2\frac{1}{2}$ feet in the century; those now presented are based on the eccentric movements of the earth's orbit.

There is a sufficiently near approximation to Lyell's to connect them together, and to add confirmation to the theory now suggested. It may be

* Lyell's "Antiquity," pages 283, 284.

† Ibid. page 285. ‡ Ibid. pages 321, 322.

said that the line S R should have been drawn from 3 to 3, instead of from $5\frac{1}{2}$ to $2\frac{1}{4}$; the reason in favour of $5\frac{1}{2}$ was, that, previous to the time of the glacial period, when those sub-tropicals, the *Hippopotamus* and *Cyrena fluminalis*, were domiciled in England and France, the northern hemisphere had enjoyed a mild and even approaching a tropical climate. The degree of heat in the surface of the earth at that time must have been considerable, and it would be long before the winter's cold could overcome the summer's heat, or the snows have annually accumulated.

Ages must then have rolled along with enervating cold, after the commencement of the period of 300,000 years, before submergence could have taken place to any appreciable extent. The commencement of the subsidence was, upon this supposition, moved from 3 to $5\frac{1}{2}$, viz., to the time at which the eccentricity was 5,500,000 miles. The line is arbitrary: it will be for others to say if it be wrongly placed, and how far.

CHAPTER IV.

GEOLOGICAL CHRONOLOGY.

(CONTINUED.)

The Miocene Glacial Epochs.

THE preceding diagram relates altogether to the post-pliocene glacial epoch ; it comprised a term of 400,000 years, embracing within it the glacial term of about 250,000 years. The next* has relation to the full term of one million of years (the extent of Lyell's tables of eccentricity), and comprehends the former.

Mr. Page, in his "Past and Present Life of the Globe," published in 1861, has given a diagram of hot and cold cycles. He states the Cambrian, the old red sandstone, the permian, the cretaceous, and the boulder drift, were cold cycles ; the silurian, carboniferous, oolitic, tertiary, and recent, were warm ; he could fix no time for any of those formations ; he had not then a table of the eccentricity of the earth's orbit, to guide him as to the ages of the warm and cold cycles, or to prove to him that there must have been such cycles. He endeavoured to establish the fact of the warmer and colder periods from the character and composition of the rocks, and by the nature of their fossil contents. Thus, for instance, that angular grits and conglomerates, with few fossil animal and vegetable forms, proved the recurrence of colder influences ; whilst exuberant

* See second diagram at end of book.

fauna and flora would indicate a warm and genial climate. He was of opinion that all pointed to a determinate law of secular succession, and that in the periodicity of this law we may yet discover the key to the expression of geological chronology in years and centuries. He earnestly solicited the attention of geologists to the subject, but his views do not seem to have met with the consideration they deserved. The time had not then arrived ; Croll's tables had not then been calculated ; and without them, or some such guide, geologists had nothing reliable whereby to test their conjectures. Now, the key anticipated by Mr. Page has been found ; a door is opening into the dark, long, past, which, if followed up by astronomers, may enable geologists to carry the chronology of the earth's formation back to the commencement of organic life.

From the second diagram here given, constructed on Croll's tables, we may place the last great glacial epoch within the post-pliocene, and between the dates of 50,000 and 320,000 years ago.

The next previous period of extreme eccentricity occurred 750,000 years ago, and another still greater occurred 850,000 years since. Thus, not only has progress been attained in geological chronology, as foreshadowed by Mr. Page, but, by the application of Croll's tables, a decided stride in placing geological periods has been made, over an extent of 1,000,000 of years.

Mr. Croll has lately made another advance, in placing the era of the previous great glaciation in the time of the upper miocene.

According to Hugh Miller's view, the sixth day of

the Mosaic vision embraced the tertiary period ; and if this theory be accepted, and if Mr. Croll's placing of the upper miocene be found to be correct, we shall not, even by those tables of one million of years, have reached as far back as the commencement of the sixth day of the Hexaëmeron, embracing, as it would, the eocene strata.

If Mr. Croll, and the other astronomers who assisted him at Sir Charles Lyell's instance, could be prevailed upon to undertake the laborious work of calculating the eccentricity of the orbit of the earth for five or six millions of years farther back, geologists might follow up the trace by examining more minutely every variation of hot and cold eras portended by the fossils and erratic grits and stones in the rocks ; and thus Mr. Page's aspirations be carried back to the beginning of organic life upon the globe, and geological chronology be attained commensurate with the first day of the Hexaëmeron.

As yet we can only reach back to the miocene, leaving the eocene outside the million of years. Page, in his "Geology for General Readers," has drawn a vivid picture of the tertiary climate. "What a picturesque and luxuriant scene," he says, "the grassy plains, and glades, and river banks of the old tertiary times must have presented—uplands fretted with scrub, lagoons and river creeks fringed with palms and tropical forest growths, and swampy deltas teeming with tangling jungle. Herds of antelope and horse-like forms scattered over the uplands ; carnivora (*hyænodon* and *cynodon*) lurking among the rocks and bushes, and by the water springs ; elephants, tapirs, and hippopotami down by the river side, and huge

amphibia lazily sunning themselves on the islets and mud banks of the far-spreading delta. Plain, lake, estuary, and sea teeming alike with life during the warmer eocene, abounding in milder forms during the still genial miocene, and gradually assuming more temperate aspects as the pliocene approached more nearly to the ordainings of the current epoch. Such were the leading aspects of the tertiary times, brought to a close by new terraqueous (glacial) arrangements, inimical (over the greater part of the northern hemisphere at least) to vegetable and animal existence."

Such is Mr. Page's description of the tertiary period, until terminated by the chill of the glacial epoch.

Although the sixth day of the Hexaëmeron may have commenced about the time of the eocene, yet the tables of the eccentricity of the earth's orbit not having been carried back so far, we must, for the present, confine ourselves within the million of years for which it has been laid down as in the diagram.

Turning to that, we find that table commencing with the eccentricity at 2,750,000 miles.

The climate was then warmer than at present. Supposing the lower miocene to have commenced at the beginning of the one million of years, and to have continued from thence to about 875,000 years; then an intercalated period of cold; then the upper miocene to have commenced about the 825,000 years, and have continued to 700,000; the pliocene, after another cold era, at 700,000 years, follows for a long period, until near the 300,000 years; the post-pliocene from that time until 50,000, when the recent succeeded, and continued until the time of Adam, or the

current period. For the better understanding of the diagram of the one million of years, and to show the accordance between the geological and the astronomical circumstances of that period, the reader is referred to Lyell's description of the tertiary and post-tertiary deposits, reversing his order, and commencing with the lower miocene, to compare with the diagram, and ascertain how far the geological facts agree with the astronomical. Here we can only give a very condensed outline. Between the secondary and tertiary periods, there had been an almost total change in the fauna and flora of the earth. Passing over the eocene, for which we have no astronomical data, we come to the lower miocene. According to Lyell, this contains scarcely any species of plants, shells, or animals agreeing with those existing at the present day. There are palms nearly allied to the date palm, and about eighty other plants, all of which would be cut off by such a winter as now prevails in central and southern Europe; and reptiles of considerable size, but differing in structure from those of recent species.

Trees flourished as far north as lat. 70° , and are now found there in a fossil state—some of the *Wellingtonia* species and several other conifera; some trees approaching the nature of beech, oak, and willow, &c., implying high summer temperature, whilst evergreens precluded the idea of a cold winter.

In the London clay of the Isle of Sheppy, are fossil fruits of the cocoa nut, screw pine, and custard apple, reminding us of the hottest parts of the globe.

The fish are also characteristic of hotter climates.

Lyell does not assign any date for this period, nor for any other of the tertiary or post-tertiary periods, even as an approximation. Let us (as before stated) place the probable time of the lower miocene as embracing from 1,000,000 years ago to the 875,000 years in the descending scale.

At 900,000 years the eccentricity was only one million and a-half of miles, that being an approach to the limit of contraction assigned to the earth's orbit by Lagrange, corrected by Leverrier, viz., 500,000 miles.

Warm Climate of the Upper Miocene.

The strata contain several shells of forms foreign to our seas as well as to our British pliocene deposits, and are indicative of a higher temperature.

At Ceninghen, in Switzerland, are found two kinds of fossil tortoises and three species of salamanders, one more gigantic in size than the living species of Japan.

Bones of the monkey tribe are met in the miocene near the foot of the Pyrenees, and a gibbon or long-armed ape, equal in stature to man.

An assemblage of fossil plants resembling those of Ceninghen, show a high degree of warmth enjoyed in Iceland. The time of this deposit we have conjectured to have been from about 825,000 to about 775,000 years past. Notwithstanding the great heat of the miocene periods, some symptoms appear to perplex the geologist. Lyell discovered supposed signs of ice action in the miocene periods. He found that large angular masses had been carried great

distances from their parent rocks. He concluded it was impossible to account for their transportation by any other means than the buoyant power of ice.

What, at the time of his writing that passage, presented an inexplicable difficulty, would be now perfectly manifest to Lyell on the examination of those tables prepared at his instance. The accompanying diagram, founded on those tables, shows that between the upper and lower miocenes, when the eccentricities contracted at one time to 2,250,000, and at another to 1,250,000 miles, there occurred a very extreme range, extending to 13,500,000 miles (a near approach to the extreme eccentric range of the orbit of the earth, according to Herschel*). It appears to have been of comparatively short duration; the two extreme ranges of heat and of cold occurring within 100,000 years. Between the upper miocene and pliocene intervened another cold cycle, when the eccentricity extended to 10,500,000 miles, and then contracted to less than 2,000,000 miles.

The Pliocene Formation, as displayed in Italy,
points to a warm climate. The extinct species of subtropical fauna, belong in a great measure to forms now most largely developed in equinoctial regions. This may have commenced about 700,000 years ago.

The British Pliocene

shows a transition from a warmer to a colder climate. In the lowest fossils are found proofs of a

* Sir John Herschel states the maximum of eccentricity to be a little more than fourteen millions of miles, and the minimum to slightly exceed half a million of miles.

climate warmer than that now prevailing in England, more resembling that of the Mediterranean. As we ascend in the series, the shells of successive groups of strata, provincially called "the crag" in Norfolk and Suffolk, consist less and less of southern species, the number of the northern always augmenting, the fauna becoming very arctic in character. From the diagram you will see that the pliocene embraced a very long period, during which, though there were several oscillations of eccentricity, the extremes of distance were only 7,000,000 and 7,500,000 miles, whilst the contraction was for a time at 4,000,000 miles, afterwards 3,000,000 and 3,750,000. The diagram only marks the distance between each grade of fifty thousand years; but it is evident that between the two grades, where the eccentricities are marked respectively as 4, there must have been a greater contraction, and a like further contraction between the periods where the distances are marked 3 and $3\frac{1}{2}$ on the diagram—the dotted lines are conjectural. Those contractions probably reached to less than 2,000,000 miles respectively; this would give for Europe a climate warmer than that of the present day. Lyell has placed the climate of the mammoth and its associates partly before and partly after the post-pliocene glacial, and that of the cave deposits after that period. One object of these pages is to call the attention of competent parties to re-examination of the subject, with a view to farther investigation.

For reasons given in subsequent chapters, the existence of the extinct mammalia has been placed in the pliocene and early part of the post-pliocene,

and at the commencement of the glacial period, and their extinction, within that period. The European glacial drift will be treated as having occurred partly during the post-pliocene, at the commencement of the submergence, and partly at the melting of the snows and ice on the decline of the last great glacial epoch.

Climate of the European Cave Deposits, and that of the Mammoth and its Associates.

Lyell states that the superficial distribution of the cave deposits, the species of mammalia, as well as the fact that their accompanying shells are of the living species, seem to connect them chronologically with that drift in which flint implements have been detected in England, France, and Italy.

Also, from the fact of rude flint implements of the earliest stone age being found in drift containing bones of the mammoth, Siberian rhinoceros, and Greenland lemming, he concludes that "*man of the early stone period had to contend with a climate more severe than that now prevailing in the same parts of Europe.*" He states that we find in some parts of the drift evidence of a conflicting character, suggesting the idea of occasional intercalation of more genial seasons, of sufficient duration to allow the migration and temporary settlement of species of mammalia coming from a more southern country, so that their remains were buried in river gravels at the same level as the bones of animals and shells of a more northern climate. Now turn to the diagram. It supports the theory of intercalation. There were

three such periods: one soon after the commencement of the post-pliocene glacial epoch, when the eccentricity contracted from 7,750,000 to 4,500,000 miles; another, after the culmination of the eccentricity 210,000 years ago, when the eccentricity retracted from 10,500,000 to 6,000,000 miles; and a third at the termination of the glacial epoch and commencement of the recent, when the eccentricity diminished from 8,500,000 to 2,250,000 miles. The whole of the last great glacial epoch, including two of the intercalations, continued during a period of between 270,000 and 280,000 years, before which time it is suggested the extinct animals were destroyed.

Professor Heer concludes, that the inter-glacial periods were of considerable duration, for they gave time for the accumulation of dense beds of lignite, like those of Dürnten and other localities near Zurich; that the climate at that time may have closely resembled that now experienced in Switzerland. Now turn to the diagram. The warmest periods, during the post-pliocene glacial epoch of 250,000 years, were two, when the eccentricity of the earth's orbit was respectively at 4,500,000 and 6,000,000 miles, the last being double the eccentricity of the present time. The climate could not, therefore, at either of those periods, have resembled that of Switzerland at the present day—it must have been more than twice as cold. We must seek farther back, and into the pliocene, for a time at which those lignite beds could have met with a climate favourable to their formation. They contained the remains of *elephas antiquus*, *hippopotamus*, and *rhinoceros*: therefore we must move back

the time of the existence of those animals to the pliocene. There is evidence that the time of the formation of those beds was preceded and followed by periods of severe cold. The periods of severe cold preceding, would have been one between the two miocenes, another between the upper miocene and the pliocene, and that following would have been at the culmination of the last great glacial epoch, or 210,000 years ago.

The Palæolithic.

“Ancient river gravels, such as those of Amiens and Abbeville in France, and Salisbury and Bedford in England, and drift of many other parts of Europe, now make their appearance.

“Here, for the first time, are encountered bones of a large number of extinct quadrupeds, such as elephas, rhinoceros, bear, tiger, and hyæna, associated with the remains of palæolithic man; the human relics consist of unpolished flint implements, of a type *different* from the latter *neolithic* era. The physical geography was then different from that now characterizing the same part of Europe. The land was at a different level from that now prevailing, and the large size of the transported stones imply much snow and ice.”

On looking at the diagram, we may, for the present, place this period as being previous to 220,000 years ago; but this is a point for investigation.

The Reindeer Periods.

There were most likely two—the first shortly after the commencement of the post-pliocene glacial epoch, when that animal, driven by increasing cold to seek his food in a more genial climate, migrated across the Pyrenees and Alps ; the other, when the great cold had abated, and he gradually returned through the mountain passes of those ranges on his way to his native home.

The Neolithic Period.

“The weapons of man then in use show a rude state of the arts, and total ignorance of metals.” This period may have been included within that called *recent* on the diagram, or from about 50,000 years, to the time of Adam. It would, at any time during that period, have been possible for man to have inhabited so far to the north as Denmark and Norway, where we find his traces immediately on top of the glacial boulder drift, ere it became covered with peat and forest timber.

The Current Age—the Bronze, Stone, and Iron.

“There is no marked divergence at this era from the present condition of things. Plants and animals are identical with the species now living.” This period may be referred to the time of Adam or shortly after.

Without those tables of Lyell's, we should have

been ignorant of any cause for those great vicissitudes ; and the *supposed* circumstance of ice action during the warm miocene periods, would have rested solely on the finding of the large angular erratic boulders in the miocene deposits. Thus a geological difficulty, which then raised unresolvable doubts, has been solved and converted into certainty ; an unexpected confirmation has been given to the sagacious conjecture of our great geologist ; an approximation to the dates of the occurrences of those hot and cold cycles has been made, subject to future correction. The science of astronomy and geological research may be thus brought to bear upon, and to confirm each other. We shall look forward with anxiety to a calculation of eccentricity for another previous million of years, and now may take leave of the million of years already tabulated at an eccentricity of two and three-quarter millions of miles, then tending evidently toward the warmth of the eocene period in the northern hemisphere, the great heat of which has been already geologically ascertained.

CHAPTER V.

ACCORDANCE OF THE MOSAIC REVELATION WITH GEOLOGICAL FORMATIONS AND ASTRONOMICAL CALCULATIONS.

THE Mosaic revelation, geological facts, and astronomical calculations (so far back as they have as yet been carried), appear to agree with, and adapt themselves to, each other. We may test this for the million of years embraced in the diagram. On the fifth day of the Hexaëmeron, Moses beheld, in his vision, the sea, the earth, and the air all teeming with strange and uncouth forms, for which he had no names. He could not tell us he had seen ichthyosaurs, plesiosaurs, and rhyncosaurs; but he portrayed them as well as his language would permit, by grouping them with the largest monsters of his day: there were, he says, “great whales, *and every living creature*, which the waters brought forth abundantly.”

He could not describe the hylæosaurs, the megalosaurs, the mosasaurs, and the iguanodons; he could not in his language depict the pterodactyles, or flying dragons, the many grades of saurians which flitted about through the air, or crept along the earth, or revelled in the sea, devouring as they went all that were weaker than themselves; he could only designate them as “the winged fowl after his kind,” and as “*every living creature*.”

The fifth day or cycle came to a close, the age of reptiles passed away, a new fauna and flora were presented to his sight, and Moses beheld the great palæotheres, the glyptodons and zeuglodons of the eocene, the dinotherium of the miocene, and the mastodon, the mammoth, and megatherium of the pliocene periods, in his vision of the sixth day. The description he gives of these is : “the living creature after his kind, the creeping thing and beast of the earth after his kind.” On the fifth day there were no cattle or beasts of the earth, and consequently their remains are not found by geologists in the secondary rocks. The sixth day brings about the age of placental mammals. All that Moses had seen and described as of that cycle are of a new creation; even the mollusca and shell-fish of the fifth day; the ammonites, belemnites, and terebratulæ (which Moses could not have seen, and therefore has not described) appear no longer—all is changed. The fossils have made a great approach towards, and intermixture with, the configuration of existing forms. The fifth day terminates with the chalk. With the eocene commences the sixth day; when was that? The diagram goes back for a million of years, into the dark recesses of formations of primeval time; but the eocene was before that period; it lay much farther back, and beyond the million of years calculated for the eccentricity by the present tables.

CHAPTER VI.

INTERMEDIATE OSCILLATIONS OF THE ECCENTRICITY OF THE EARTH'S ORBIT.

TURNING to the diagram, the angles of the lines represent the position of the eccentricity of the earth's orbit in millions of miles, at given periods of 50,000 years in each. Looking at those lines, we must not lie under the impression that the course of the eccentricity was undisturbed, or that it lay in direct lines, as represented in the diagram ; on the contrary, its progress was periodically affected, and minor oscillations were produced—some by the precession of the equinoxes, others by the apsides or attractions of the planetary bodies : neither must we conclude that the cold periods were exactly commensurate with the distances of the eccentricity. The question as to whether the winters of the northern hemisphere occurred when the earth was in perihelion or in aphelion, would have to be taken into consideration before the positive heat or positive cold of any extreme range of the eccentricity could be guessed at approximately. For instance, during the pliocene three cold ranges of eccentricity occurred of only seven and a-half and seven and three-quarters millions of miles, whilst warm ranges contracted to two and three millions of miles. The early pliocene was a warm period, yet there were those cold ranges.

If the winters in the northern hemisphere, during those cold periods, occurred when the earth was in perihelion, the temperature during those eras might have been greatly modified. Professor Tyndall argues that the ancient glaciers indicate the action of heat as much as the action of cold. "Cold," he says, "will not produce glaciers. You may have the bitterest north-east wind in London without a single flake of snow. Cold must have a fitting object to operate upon, and this object (the aqueous vapour of the air) is the direct product of heat," &c.* The lines of eccentricity represented in the diagram, though not exhibiting the minor oscillations, are sufficient for the purposes of general approximation. These may be followed up and corrected hereafter by further calculations, and thus greater precision on this part of the subject may be ultimately attained.

If their periods be rightly placed in the diagram, there occurred between the upper and lower miocene an extreme range of eccentricity of 13,500,000 miles, and between the upper miocene and the pliocene another of 10,500,000 miles. The earth, in its northern and southern latitudes, lay (during those periods of cold) deeply buried in snow and ice. The returns from extremely cold to warm periods were accompanied by great thaws and by corresponding floods; much of the eocene and miocene formations were swept away by those floods, and the surface of the earth greatly denuded. In the valleys, the upper strata were scooped out, even down to the chalk and oolite. The fact of this erosion, if estab-

* "Heat considered as a Mode of Motion," page 192.

lished as the result of the miocene floods, may be important ; we shall again refer to the subject.

When the tables of eccentricity of the earth's orbit shall have been continued for some millions of years farther back, it will be interesting to trace the agreement between the several strata composing the earth's surface and that of the warm and cold cycles indicated by those tables, and to assign to those formations their respective chronological periods ; to mark the termination between the secondary and tertiary formations, and to ascertain by what great eccentricities of the earth's orbit that period was influenced ; When the fauna, flora, and marine formations of the secondary period were extinguished ; Whether there was a long protracted cycle of intense cold, during which the then several existences upon the earth were brought to a close, or that their annihilation took place through a succession of eccentric movements of the earth through its orbit, each of them, perhaps, extending to the utmost limit of the range of eccentricity. We may then be enabled to assign some approximate time for the destruction of the equilibrium of some part of the earth's surface by the meridional fractures intimated by Professor Haughton, in his "Manual of Geology,"* when the great arches or domes of the earth's crust of the southern hemisphere were burst up or had fallen in, when the continuity of the earth's surface in the southern hemisphere was broken, and great portions of it sunk to the bottom of the ocean.

Professor Haughton concludes that some of these

* Appendix B, pp. 146-149.

events had occurred during the cooling of the earth, and before there was animal life upon the globe. He states that parts of the present line of elevation had taken place along a line of ancient fissure during the period preceding the tertiary; that the meridional lines have always been lines of either elevation or depression, and have constituted alternately the axes of continents or the valleys of the ocean.

Mr. Staniland Wake, in his "Chapters on Man," has entered fully into the subject of a submerged continent in the Indian Ocean, which he contends had been fully peopled by man before its submergence. With respect to the great lapse of time there was between the recurrence of glacial periods, he quotes from Mr. Croll's letter, at page 659 of the 4th volume of the *Reader*, to show that while the maximum of cold must have occurred somewhere about 200,000 to 210,000 years ago, the eccentricity of the earth's orbit will, for more than 100,000 years to come, remain too low to allow of that vast accumulation of ice at the poles which marks a glacial epoch.* He adds: "If Mr. Croll's hypothesis be true, and the opinion that man existed in the southern hemisphere toward the beginning of the tertiary period, and previous to the depression of the earth which caused the Indian Ocean, be well founded, man cannot have originated less than 200,000 years ago."

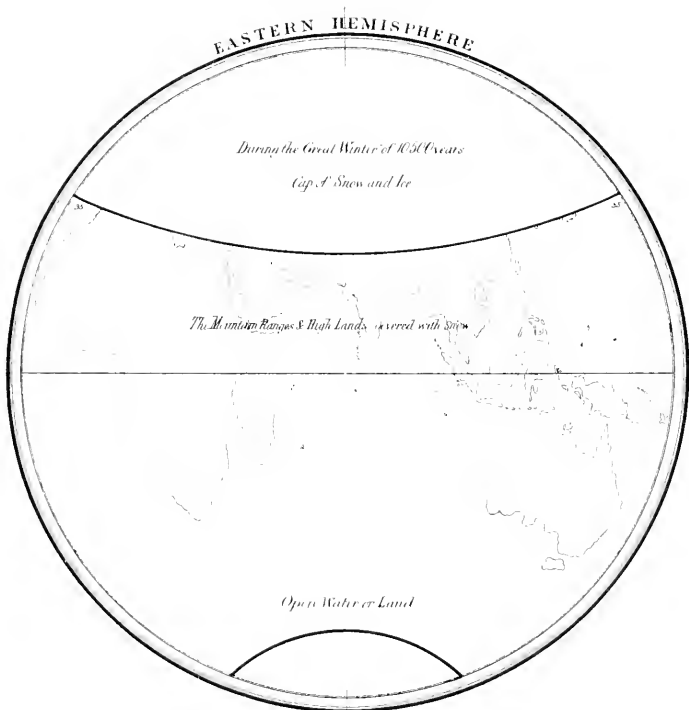
He also adds, that Professor Jukes states he has long thought the human race to have existed

* Wake's "Chapters on Man," page 286.

at least 100,000 years. He thinks that few geologists will be found to affirm "that either of the above periods is too long." The beginning of the tertiary period, assigned by Mr. Wake for the appearance of man, is quite too far back, being beyond the million of years ; but, on the other hand, the term of 200,000 years is too short, and falls about the time of the culmination of the post-pliocene glacial period—a time at which it is unlikely that animal life could have existed to the north of the 40th degree of north latitude.



*The North Pole represented in Aphelion during a high
eccentricity of the Earth's orbit. See Appendix A. 3*



*For the periods of long Winters & warm Summers of
the Poles see Appendix A. 3*

CHAPTER VII.

PRE-GLACIAL ANIMALS AND MAN.

OF the largest and most important of the several races of animals which were in existence before the last great glacial period, but are now extinct, we shall select nine, by way of illustration, viz., three classes of elephant (including the mammoth), the rhinoceros *etruscus*, hippopotamus major, *ursus spelæus*, *bos primigenius*, *hyæna spelæa*, and *felis spelæa*.

Lyell has convincingly shown that those animals were in existence in Europe and in the north of Asia previous to the post-pliocene glacial epoch.

He has also established decidedly, that man was at some period cotemporaneous with them.

There is a doubt as to the time at which they were cotemporary.

I shall endeavour to show that such co-existence was pre-glacial, and not post-glacial.

Prior to that glacial period, those animals enjoyed, in the latitudes of France and England, a mildness of climate approaching to tropical. This state of climate was succeeded by one of intense cold, which gradually crept over the temperate and polar regions of the earth, and rendered a great portion of the northern hemisphere uninhabitable.

Turn to the outline of the eastern hemisphere :

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Turn to the outline of the eastern hemisphere :

there, snow-caps are represented as encroaching to the 35th degrees of north and south latitude, and showing the probable state of the earth during the last glacial epoch.

What at that time became of the previously existing animals of Europe? Whither could they have escaped? Toward the south their exit would have been barred by extensive ranges of snowy mountains and encroaching seas. The Pyrenees, the Alps, the Caucasian, the Altai, and Stanovoi chains, extending from the Bay of Biscay to the Sea of Okhotsk, would have presented an impassable barrier. South of those, other ranges of mountains, running nearly parallel to the 40th degree of north latitude, with intervening seas, would have cut off all chance of escape in that direction. To the north of them those animals could not have existed; and in the countries where we now find their bones and frozen carcasses, were they not compelled to remain until their races gradually became extinct?

We now arrive at the main question: These extinct races of animals whose bones we now dig up—were they pre-glacial or post-glacial? If pre-glacial, were the fabricators of the palæolithic flint implements pre-glacial and cotemporaneous with the extinct mammals among whose remains they are now found, or were they post-glacial?

Lyell is of opinion the animals were pre-glacial as well as post-glacial. If so, where did those pre-glacials dwell during the glacial period? How did they escape from its rigours so as to perpetuate their races? It has been suggested that some of them found their way to the south of those snowy mountain ranges

at the early stage of the glacial period, and that thus they were enabled to preserve their races ; that their descendants returned to Europe when it again became habitable, and replenished that part of the earth, previously inhabited by them, with their respective progenies. But is this likely ? Is it probable that, after a lapse of 250,000 years, descendants of each of those races returned to inhabit the old country, not one of the nine kinds missing—none of their races extinct after such a lapse of time ? Supposing them to have done so—to have returned after the post-pliocene, and during the recent deposits—how could their remains have got into the glacial drift ?—or, surviving the glacial epoch (if they did so), why should not their several races have existed down to the present time ?—how or when in the recent period were they extinguished ? or by what calamity were they so completely cut off ?

Had the bones of these huge extinct animals been generally found upon or lying over the boulder drift,* it would have been evidence of their being of a later age. Had they been in any instance found in the drift which underlies undisturbed boulder clay, it would have conclusively proved the animals to have been of pre-glacial times ; but where, from the flowing of rivers, or other circumstances, the glacial boulder drift has been cut through, and where bones are found in the underlying gravels com-

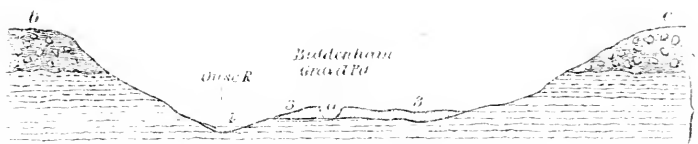
*Sir John Lubbock, in his "Pre-historic Times," mentions that in one instance the bones of extinct animals were found resting on the boulder drift. But may not these bones have been floated there by an iceberg, or have fallen from, or have been washed out of, more ancient strata ?

mingled with other deposits, it has rendered it doubtful whether the animals were pre- or post-glacial. This is the very point in which the difficulty lies, and we should not rest satisfied that the evidence heretofore obtained has been conclusive.

We must feel the impossibility of those animals having either passed to the south over those snow-clad mountain ranges, or having returned again at any time during the glacial period, when we recall the fact, that at that time great glaciers extended over those mountains, filling up their numerous valleys and gorges, from the tops of the Alps to beyond the Jura ranges on the one side, and to the 35th degree of north latitude on the other ;* that, so far as Mount Lebanon, the country was deeply covered over with snow ; and that three successive sets of glaciers pressed upon the mountain sides where afterwards grew the cedars used in building the temple of Solomon.

Sir Charles Lyell, from an examination of the gravel-pits at Biddenham, came to the conclusion that the fabricators of the antique tools were all post-glacial. He remarks,† that, besides the flint implements found there, several others of a corresponding type were found at other localities in the Valley of the Ouse. Those tools were all of the ancient type of the palæolithic period. He contemplated the river's current having (after the post-pliocene glacial epoch) swept away all deposits down to the oolitic rock, and then having there deposited the gravel in which the bones and flint implements are found.

* Lyell's "Principles of Geology," page 196. † Ibid. page 164.



Section across the Valley of the Ouse, two miles WNW of Bedford.

1. Gault strata.
2. Boulder clay, or marine northern drift, rising to about ninety feet above the Ouse.
3. Ancien, gravel with elephant bones, freshwater shells, and flint implements, also bones of hippopotamus and rhinoceros.
4. Modern alluvium of the Ouse.
4. Biddenham gravel pits, at the bottom of which flint tools were found.

Turn to the Biddenham diagram, No. 3. The boulder clay bed, originally continuous, was afterwards cut through by the river. Suppose the river had not penetrated the strata of boulder clay, and that, on excavations being made down to the bottom of the gravel-pit at A, the bones and flint implements were found, it would leave no question but that both were pre-glacial.

The boulder drift was 90 feet higher than where the bones were found. At the bottom, and resting on the solid oolitic rock, lay the flint implements; over them, the bones of the elephant and rhinoceros; over that, 13 feet of stratified sand and ancient gravel, mixed on the top with large granite stones of the northern boulder drift. How did they come there? Whilst the river's stream was cutting through the boulder drift, the clays and smaller stones were washed from under and about the heavier rocks. What would have been the effect of the continuance of this process? So long as the stream could sweep away the softer and lighter parts of the intervening deposits, the heavy blocks would continue their descent, until they rested upon a base undisturbed by the river's stream. Was not this base the ancient gravel bed, lying upon which, or mixed with which, these granite boulders are now found?

Under those rocks, and in that undisturbed ancient gravel, lie the bones of the extinct animals and the rude implements of early man.

Had the boulder drift been prior in point of age to the ancient gravel, when the river had excavated its way down to the oolitic rock, the heavy boulders of that northern drift, on subsiding, would have

rested upon the solid rock, the ancient gravel lying over. But those boulder rocks are found either lying on top of or mixed with the upper part of the ancient gravel, the bones and implements lying underneath and resting on the solid rock. Is this not strong presumptive proof that the ancient gravel was the older deposit, and the bones and implements pre-glacial? Had the bones of those extinct animals and the palæolithic implements been originally deposited on top of the boulder clay after the glacial period, is it likely they could have remained together for thousands of years, rolled along as they would have been, whilst the stream was cutting its way through the 90 feet of boulder drift and other underlying deposits? The bones and flints were of different weight and volume; they could not have been hurried down the current of the river in company. The bones would have been rolled and water-worn, and separated from the flints for miles; their being found in proximity, and unworn by the river's action, goes far to prove, that where they first were covered over by the drift of ancient gravel, there they lay together until separated by the hand of man. It is remarkable that in most instances the bones and palæolithic implements have been found in the lowest beds of drift, some resting upon the oolitic rock or on the chalk, others but slightly above it. In the previous chapter, erosion down to the chalk was attributed to the floods caused by the melting of the intercalated snows of the miocene periods; we, therefore, need not have recourse to the river's floods, which occurred after the last glacial epoch, to account for the scooping into the chalk and oolite. There is

evidence to show that those rocks had been cut into and laid bare for thousands of years before, and had been again covered over with other deposits.

At Bramerton, where the crag is exposed, the lower crag rests upon the chalk, and contains quantities of elephant and hippopotamus remains, also those of an extinct species of stag. This stratum is in direct contact with an overlying bed of marine shells; these, again, are commixed with land shells; above this is the upper Norwich crag, the remains of which are of an exclusively marine character.

Here you have an instance of erosion down to the chalk, which must have occurred previous to the post-pliocene, and, most probably, during the miocene floods. The imbedded remains of the elephant were of the pliocene period; the marine shells of the overlying upper crag belonged to the time of the submergence which occurred during the subsequent glacial period.

In many other places elephant beds have been found directly superimposed upon the chalk, without any intervening strata of eocene or miocene, such as those at Mundsley, where the mammalian remains, together with the tree roots and stumps, are placed immediately upon the chalk. Overlying this stratum is a thin layer of *lignite*, sands, clays, and shells, and over these, the glacial boulder drift or till. At Cromer the strata are precisely similar.

The forest and mammalian beds resting on the chalk, proves the one to have grown, the other to have been deposited, after the glacial floods of the miocene periods had worn their way down to the chalk; whilst the beds of glacial boulder drift,

pressing upon and sealing them down, proves them to have been deposited prior to the post-pliocene glacial epoch. No human remains have as yet been discovered in those beds. The elephant beds near Amiens, those of the Valley of the Somme, those at Abbeville, and those of St. Acheul, all of which contain the remains of extinct animals mingled with the traces of man, are lying *on the chalk*; whilst those of Biddenham (also containing human implements) repose upon *the oolitic rock*.

If those beds resting on the chalk were all of cotemporaneous formation, or of the pliocene or the early part of the post-pliocene period, were not the extinct animals whose remains were embedded therein, cotemporaneous with those deposits? If so, were they not pre-glacial (that is, in reference to the post-pliocene glacial epoch)—were not their races extinguished during that epoch, the effects of which were so striking and so severe, as to have paralyzed a great portion of the northern as well as southern portions of the earth, and to have left their influences impressed upon many countries down to the present day? As yet, the extreme cold of the post-pliocene glacial period is observable in Europe and Asia, even so far south as the Pyrenees, the Alps, and the Caucasian range of mountains.

Von Baer, of St. Petersburg, states that the ground is now frozen permanently to the depth of 400 feet, at the town of Yukutz, on the western bank of the Lena, in latitude 62°.

Midendorf told Sir Charles Lyell, in 1846, that in his town, in Siberia, three years before, he had bored to the depth of 70 feet; and after passing

through much frozen soil, had come upon a solid mass of pure transparent ice, the thickness of which, after passing through two or three yards, they were unable to ascertain.

The Rev. Mr. Brown, in his book on "Icy Caves," states that Von Kotzebue and his party, having encamped on a large plain in Siberia, discovered a fissure, which revealed the fact that the moss and grass on the surface was a thin coating on a layer of ice 100 feet thick ; that this was not mere frozen ground, but aboriginal ice, which formed the walls of the fissure. They found the bones and teeth of the mammoth embedded. Those large animals could not have lived and multiplied on such slender fare as moss, nor could they have existed and found sufficient nourishment at any time in Siberia, since the culmination of the last great cycle of glacial cold.

In the flat country, near the mouth of the Yenesie, between latitude 70° and 75° north, many skeletons of mammoths retaining the skin and hair have been found. Lyell states that, in 1803, Mr. Adams obtained the entire carcass of a mammoth in latitude 70° north. It fell from a mass of ice, in which it had been encased, on the banks of the Lena. So perfectly had the soft parts of the carcass been preserved, that the flesh, as it lay, was devoured by wolves and bears. He mentions other skeletons of the mammoth which were found, one at latitude $66^{\circ} 30''$ north, with parts of the flesh in a perfect state, and that the bulb of the eye of one is now preserved in the museum at Moscow.

Sir Charles Lyell remarks : "One thing is clear,

that the ice or congealed sand, in which the bodies of such quadrupeds were enveloped, *has never once been melted since the day when they perished*, so as to allow the free percolation of the water through the matrix ; for, had this been the case, the soft part of the animals could not have remained undecomposed."

It may be said that this animal, found by Mr. Adams, was enwrapped in the ice after the glacial period. Let us consider that question.

We can conceive a time, during the early pliocene period, when the vast now ice-bound hills and plains of Siberia were covered with pine forests and with prairies bearing a luxuriant vegetation ; when woolly elephants and many other animals browsed upon their shrubs and grasses, and reclined under the shade of their forest trees.

Again, we can follow in our mind the gradually increasing eccentricity of the orbit of the earth, until its distance from the sun during the winter season became so extended, that the effect of the rays of the summer sun, feebly falling through clouds, fogs, and mist, upon the gelid surface of the northern zone, hardly sufficed to enable the animals inhabiting those *then* icy regions, to sustain their struggle for life : winter after winter herds of them perished from the increasing intensity of cold, and became encased in snowy shrouds. At length the heat of the sun was unfelt ; the whole country, so far as the 40th degree of north latitude, became enveloped in an icy mantle ; the struggle for existence was at an end, and all animal life within that region *became extinct*. The mammoth we have mentioned, when full of life and health, being suddenly en-

tombed, would have been preserved by the intense cold in the same state of freshness as at the moment of his being frozen ; and whether the time to elapse, between his incarceration and his subsequent liberation by the melting of his icy coating, were one year or thousands, still his solid flesh would have undergone no change.

As to his having been shut up during the wane of the glacial period, there are difficulties and insuperable objections. First, it is obvious that, during the intensity of the glacial period, all animal life must have been destroyed within 40 degrees of the north pole ; that, from the extraordinary number of the fossil bones of elephants found near the arctic circle, that country must, at the period of their destruction, have been thickly inhabited by these unwieldy animals ; and from the remains of some having been found preserved in such a fresh state, many must have been in actual active life when overwhelmed in the snow. The conclusion forced upon us is, that the mammoth was imbedded in ice on the approach of, or in the early ages of, the glacial epoch, and not at its decline.

Along with the bones of the extinct mammalia, were found many shells of mollusca, some of them altogether pre-glacial.

The *cyrena fluminalis*, a mollusc inhabiting these countries in abundance in pre-glacial times, when the climate was mild, would be now unable to resist the cold of Europe. It is at present only to be found in more genial latitudes. "It inhabits the Nile and many parts of Asia, including Cashmere, where it abounds."*

* Lyell, page 123.

It has been found fossil at Menchecourt (Abbeville), in the sand and gravel overlying the lowest beds, in *contact with the chalk*. In those deepest beds were found the remains of the mammoth and other extinct mammalia, together with flint knives; and in the neighbouring corresponding gravels were discovered palæolithic flint hatchets, some perfect, others much rolled.*

In page 155 of his "Antiquity of Man," Lyell mentions that the sands and gravels of Menchecourt, and those of the ancient alluvium of the Thames, were of the same age; that the fossil mollusca and mammalia of the two districts agree very closely; and that the *cyrena fluminalis* was common to both.

At Grays Thurrock, in Essex, in strata of brick earth, loam, and gravel, were found the remains of the *elephas antiquus*, rhinoceros, *hippopotamus major*, and several other extinct genera; and amongst the accompanying shells, the *cyrena fluminalis* was extremely abundant. It was associated with the *unio littoralis*, also in great numbers. Lyell adds: "This conspicuous fresh water mussel (the *unio*) is no longer an inhabitant of the British Isles, but still lives in the Seine and Loire."†

In page 159 he says: "The relation of the glacial period to alluvial deposits, such as that at Grays Thurrock, where the *cyrena fluminalis*, *unio littoralis*, and the *hippopotamus*, seeming rather to imply a warmer climate, has been a matter of long and animated discussion. When did those tropical molusca and hippopotami, whose climate is now

* Lyell's "Antiquity of Man," page 123. . † Ibid. page 157.

Egyptian, whose home is in the Nile, inhabit Great Britain? They could not have existed in England during the glacial period; they could not have come here since. They must have been denizens of these latitudes when the climate was milder than at present. If it be conceded that their period in England was before the glacial, and that they became imbedded in the brick earth, loam, and gravels at Grays Thurrock before then, when were the antique implements of man placed beside them? Were they cotemporaneous, or were there 250,000 years between the periods of their entombment?

Suppose these gravels and brick earths, in which the remains of the hippopotami and mammoths were found, were decidedly post-glacial, yet that would not prove the animal remains imbedded therein to have been also post-glacial. Prior to the higher lands of Europe being buried deeply in snow and ice, and the low lands submerged, there must, on the steady approach of the glacial era and consequent subsidence, have been a retreating of the mammalia before the encroaching sea, and an effort to attain a higher ground, even by forcing a passage through the ice and the snow—but in vain. When the mountains were covered, as Greenland is now, with 2,000 feet of snow, when the low lands were submerged, the struggles of the mammoth and other great animals for life must have been ineffectual; herd after herd would have been frozen up, and buried deep in drifts of snow. On the wane of the glacial period, some of the carcasses would have been from time to time released, and washed into hollows and beds of rivers, some buried in the drift, some floated

away in icebergs, and buried in distant lands, amidst *brick earth* and *gravels*, others in ancient alluvium, or in the moraines of glaciers; and thus, though some would be found in ancient deposits, some in more recent, the extinct animals may have been all pre-glacial.

It has been asked, If these ancient implements were really the work of human hands, why should not the bones of the fabricators be found amongst them, as well as bones of the extinct animals?

The bones of man were small, hollow, and filled with marrow; they could not resist the teeth of the hyænodon. The bones of the elephant and other extinct animals which have been preserved to us, were hard, and solid to the core, and did not contain any marrow.

CHAPTER VIII.

THE PALÆOLITHIC.

WITH respect to those human implements, there are other arguments in favour of their being pre-glacial. Palæolithic implements have been lately found in the south of Hampshire, in a tabular mass of drift, which caps the *eocene* tertiary strata.

The first implements discovered there were found included in gravel from 8 to 12 feet thick, and 35 feet above high water mark.* The flint tools were of the palæolithic type, resembling those found at Abbeville. Others of the same kind were found buried in the glacial drift, 100 feet above the level of the sea.

The stones contained in and lying upon the gravel on top of those cliffs, are some of them of enormous dimensions—more than 20 feet in circumference.

Lyell states that the position of these implements attests, in a more striking manner, the antiquity of pre-historic man in Europe, than any other monument of the stone age yet discovered. The great bed of gravel resting on *eocene* tertiary strata, in which these implements have been found, consists in most places of half-rolled or *semi-angular chalk flints*, mixed with rounded pebbles, washed out of the tertiary strata.

* Lyell's "Principles," pp. 562-564.

To explain how these stones and implements became enveloped in the debris of chalk flints, Lyell says we must have recourse to ice.

He farther remarks, that there are three independent classes of evidence in this part of Hampshire, pointing distinctly to the vast antiquity of palæolithic man.

1. The great denudation of the chalk and tertiary strata, and the important changes in the depth of the valleys and the contour of the sea-coast, which have there occurred since the deposition of the implements.

2. The marked change in the fauna, by the dying out of so many conspicuous species of quadrupeds.

3. The change of climate from a colder to a warmer temperature, implied by the former presence of northern animals, and by the ice-borne erratics of the drift.

He says : “ If we ascend the Avon from Christchurch to Salisbury, about 30 miles to the north, we find at various heights above the river, and in old fluvatile alluvium, flint tools of the same palæolithic type. One of these was taken out by Dr. Blackmore, from beneath the remains of a mammoth, at Fisherton, near Salisbury.”

There were found in the same deposits the remains of twenty-one species of mammalia, and among them the mammoth, the woolly-haired rhinoceros, the reindeer, the northern lemming, the Greenland lemming, &c.

What was the position of these implements, which Lyell considers so important in showing the vast antiquity of pre-historic man ?

Some of them were 35 feet, others 80 feet, and some 100 feet above the level of the sea.

They were found embedded in the glacial drift. There were found in this drift, and connected with it, stones 20 feet in circumference, which, according to Lyell, could only have been brought there by ice.

One of these implements was discovered under the remains of an extinct animal.

If those enormous stones and glacial drift were floated to their present position by icebergs, must not the land have been then depressed beneath the waters of the ocean? If they were brought there by great glaciers, must not the land have been then covered with snow and ice? In either case, the event occurred within the glacial period; and if my theory be right, palæolithic man and the extinct animals were destroyed during that period. I shall, in a future chapter, enter more fully into the consideration of that age when England and the Continent were united; when these extinct pre-glacial animals roamed freely over land from the France to the England of that period, before the severance of the two countries, which occurred during the reign of submergence in the glacial times;—of the total extinction which then took place of all those pre-glacial animals through cold, from snow, by ice, and by the waters of the overwhelming ocean; of the total impossibility of their races having been subsequently restored to England when the climate moderated, the severance of the countries by the British Channel at the Straits of Dover having formed an impassable gulf.

I shall now pass to a few more facts confirmatory

of the very early appearance of palæolithic man upon the earth, before adverting to the neolithic and bronze periods.

Sir John Lubbock, in his introduction to the work of Professor Nilson, on the "Primitive Inhabitants of Scandinavia," says, as to the palæolithic age: "This is the most ancient period in which we have as yet any decisive proofs of the existence of man."

In page 13 he says: The fauna of Europe at that time comprised the mammoth, the rhinoceros, the hippopotamus, the urus, musk ox, &c.

That the climate was much colder than at present.

That man had already inhabited Western Europe.

That he used implements of stone which were *never polished*, and of which some types differ remarkably from any of those that were subsequently in use. In examining his eleven conclusions (of which the above are four), he says: "The great antiquity of the period now under discussion, is evident from several considerations. The extinction of the larger mammalia must have been a work of time, and neither in the earliest writings nor the vaguest traditions do we find any evidence of their presence in Western Europe."

In his observations on the neolithic age, Sir John also lays down several propositions, of which we shall take the three first: 1. There was a period when polished axes (of stone) were extensively used in Europe. 2. The objects belonging to this period do not occur in the river drift gravel beds. 3. Nor in association with the great extinct mammalia.

These observations lead us to consider the great gap which must have occurred between the palæolithic

and neolithic periods. There was no intermixture, no gliding of one insensibly into the other. The ancient rude stone implements were not found intermingled with the bones of the fauna of the neolithic period; the polished and more advanced neolithic implements were not discovered along with the remains of the extinct animals. There appears to have been an extended period—a vast gulf between. The great mammalia became extinct. Their extinction, as Sir John Lubbock states, must have been a work of time. The cotemporary fabricators of those early rude implements, came to an end with the extinct animals. There must have been some great catastrophe to have produced such an utter destruction, to have separated the extinct mammalia from the existing, to have divided the palæolithic from the neolithic period. For this the glacial epoch would sufficiently account: extra this cause, by what other known means could it have been accomplished? We find that these great animals of extinct races inhabited Europe before that period; we find, cotemporaneous with them, traces of man. They were together; a great break occurred. The races of these animals, and the men by whom they were slaughtered in the chase, became extinct at the same time: the fabricators of those rude implements ceased their labours. Those implements and those animals passed from the stage at the same period—a period of intense cold, according to Sir John Lubbock—a period *before* or cotemporaneous with the river drift and gravel beds. Then came a new fauna, and with them a new class of stone implements, both subsequent to the drift, and decidedly post-glacial. Suppose some of

those extinct races had, by some chance, been able (in a more southern clime) to continue their progeny for nearly 250,000 years, during the glacial period, and their several races had then returned again to Europe and to Northern Asia, why should not those races have been continued until historic times? How did they happen to cease suddenly, and give place to the fauna of neolithic times? How did their remains become embedded in the drift, in the ancient gravel, or under the heavy stones of the northern boulder drifts? If the palæolithic period was post-glacial, why did it not blend with the neolithic, or why were not neolithic implements found among the remains of extinct animals?

We now pass to the neolithic epoch.

This was post-glacial. When the eccentricity of the orbit of the earth contracted to 2,250,000 miles, the re-emergence had culminated, and the land rose to about its height at the present day. From that time the climate became so ameliorated, that the human race was able once more to inhabit the northern parts of the earth. Lyell, in his "*Antiquity of Man*,"* describes peat mosses of Denmark, from ten to thirty feet deep, formed in hollows *of the glacial boulder drift*, and in which lie embedded Scotch fir-trees, often three feet in diameter. He remarks that this tree is not now, nor has ever been in historical times, a native of the Danish islands; that, when introduced there, it has not thriven, yet it was evidently indigenous there within the human period. Steenstrup (he states) had

* Tenth edition, page 9.

taken out, with his own hands, a flint instrument from below a buried trunk of one of those pines. Century after century the pine-trees grew up, flourished, and decayed; they were succeeded by other forests of pine, which, in their turn, reached maturity, perished, and were covered over by the peat. At length this kind of tree became exhausted, and totally disappeared from Denmark. It was afterwards supplanted by the sessile variety of the common oak, of which many prostrate trunks are found higher in the peat than the pines. This kind also ran its course of growth, maturity, and decay. Still higher again in the peat, occurs another variety of oak, accompanied by alder, birch, and hazel. The oak has now been almost superseded in Denmark by the beech. That country was covered by great beech forests in the time of Julius Cæsar, and as yet they flourish there in full perfection, that tree not having run its course nor become exhausted. The white birch appears in the lower, but disappears from the upper part of the bogs. All the mammalia as well as plants which occur buried in the peat, are of the recent period. Lyell states that the neolithic stone age in Denmark coincided with the period of first vegetation, viz., that of the Scotch fir (the first after the glacial epoch), also with the sessile oak. The latter portion of the oak era coincided with the age of bronze. He states that the bronze was introduced into Denmark when the aboriginal inhabitants were conquered by an invading people from the East; that, scattered through the Danish Kjökkenmödding, or refuse heaps of shells, are numerous flint knives, hatchets, and implements of stone, horn, wood, and

bone, but never any of bronze or iron ; that the stone hatchets have been sharpened by rubbing, and are less rude than those of the palæolithic age found associated in France with the bones of extinct mammalia ; that these mounds are from three to ten feet high, and some of them 1,000 feet long, and from 150 to 200 feet wide.

These refuse heaps are so old, that though the shells of the common edible oyster among them are of the full size, yet those fish cannot live at present in the brackish waters of the Baltic. That the bones of the domestic ox, horse, and sheep, are wanting in these mounds, but are found in that part of the Danish peat formed in the ages of bronze and iron. These refuse heaps, therefore, are older than the ages of fir and sessile oak found in the peat bogs.

The most ancient Swiss lake-dwellings appear to have been of the same age as the peat borne implements of Denmark.* They belonged to the age of neolithic man. Hundreds of implements, resembling those of the Danish peats, have been dredged up from the mud into which the piles supporting the Swiss lake-dwellings were driven.*

The wooden piles which supported the dwellings of the people of the stone era, are more decayed than those of the bronze period. Many facts relating to the neolithic stone age are advanced by Lyell, to prove the very great antiquity of the man of that epoch ; but sufficient has been quoted for my purpose, to prove that man of the neolithic period had a very

* Lyell's "Antiquity," p. 17.

great antiquity before the bronze era commenced. Attempts have been made, by calculating the probable rate of the growth of peat, the silting up of lakes, &c., to fix the time at which the fabricators of those neolithic implements existed, but without any satisfactory result. We may venture to fix a period farther back than which it could not have extended, viz., at the amelioration of climate after the post-pliocene great glacial epoch, and when the eccentricity of the orbit of the earth had reached the great contraction of 2,250,000 miles, which occurred 50,000 years ago. That is an extreme limit. It may have been far short of that time when the glacial chill had been so overcome as to permit again the approach of human life in Europe, or when neolithic man first made his home in Denmark. This much is certain, from the position in which many of those implements were found; from the depth of the peat, and the growth and succession of great forest trees over each other; from the huge accumulated piles of shells of the refuse heaps, and from the great multiplicity of the implements discovered;—a vast cycle of time must have passed over between that, when neolithic man first dwelt in Denmark, and that of the commencement of the era of bronze.

Look to the circumstance of the Jära wall, lying along the coast of the Baltic—peat bog to the depth of ten feet passing under it and into the sea—as described by Professor Nilsson.* He states this wall to be composed of gravel and stones (probably an ancient sea beach); it is high and broad in some

Nilsson on "The Stone Age," page 254.

places, in others, several such walls lie behind each other ; that the turf of this underlying bog is, when dry, almost as hard as coal ; that the fir found in it is, when broken, black and shining in the cross section—all the results of great pressure and age ; that, under this peat bog, and on the fine blue clay itself, there have frequently (during the cutting of the turf) been found arrowheads, knives, &c., of flint, which proved that human beings already existed there at the time *the peat began to grow. No bronze implements were found in this peat.* Bronze was in use at a very early period—copper at a still earlier.

In all likelihood, the fabricators of implements of bronze or brass existed during the days of Adam. Tubal Cain was *an instructor of every artificer in brass and iron.* Tubal Cain was the seventh in descent from Adam. The dates of the births and deaths of the progenitors of Tubal Cain are not given in Scripture, as are those of the descendants of Seth ; but we find Lamech, the eighth in descent from Adam, through Seth, was cotemporaneous with Adam for fifty-six years.

Adam thus lived to see his descendants of the eighth generation, through his younger son, Seth : is it not likely that he lived also to the time of the seventh generation of descent, through his eldest son, Cain ?

We may thus fairly infer that Adam lived in the age of bronze, and that, in all likelihood, even during his life, his descendants were casting aside the use of stone implements, and adopting those of bronze.

The stone period did not cease with the discovery

of bronze. There was no gap between the bronze and the stone, as there had been between the palæolithic and neolithic ages ; they blended together ; and though the use of the bronze was gradually adopted by all civilized people, that of stone was retained by savage nations, and has (with slight exception) remained in use among them in many countries until the present day.

The whole subject is deeply important, as well as in a geological as in an archæological and astronomical point of view, and fully deserving of careful consideration. It is presented here under a somewhat novel aspect ; and a hope is indulged that others more competent may be induced to pursue the inquiry, and that further geological discoveries will enable them to attain a greater degree of certainty on this interesting subject.

CHAPTER IX.

SEVERANCE OF FRANCE FROM ENGLAND.

Kent's Cavern.

It is received by the most eminent geological authorities as an established fact, that there was a time during which Great Britain and Ireland were in the state of an archipelago of small islands.

There was subsidence of the land to the depth of 2,000 feet, which continued for thousands of years, during a period of intense cold. For a great portion of that period, the tops of the mountains of Great Britain and Ireland appeared only as islands in the deep.

Before that time, England and France were united to each other, and formed but one continent. Where the waters of the British Channel now surge, there grew a great forest—the forest of Cromer.

Of the fact of the existence of the submerged forest, we should probably have remained in ignorance, were it not that, after heavy gales, at times, vast bodies of sand and shingle are cleared away by the violence of the sea from the bases of the chalk cliffs of Norfolk and Suffolk: when this occurs, there stand disclosed the roots and stumps of the ancient trees of the forest.

Lyell* states this buried forest to have been traced

* Page 214.

for more than forty miles, being exposed at certain seasons along the beach, between high and low water-mark; that its remains extend from Cromer to near Kissingland, and consist of the stumps of numerous trees, standing erect, with their roots attached, and penetrating in all directions into the loam or ancient soil on which they grew. Some of these trees were two and even three feet in diameter.

The same author,* in referring to the fresh water formations with lignite, on the borders of the Lake Zurich and other Swiss lakes, remarks :

“Like the buried forest of Cromer, they are all *pre-glacial*; yet they, by no means, represent the older, nor even the newer pliocene, but rather the beginning of the post-pliocene.”

Referring to the deposits on the borders of the Lake Zurich, as at Utznach and Dürnten, he states that “in working in the bed of lignite, many organic remains came to light; amongst these, the teeth of the *elephas antiquus*, *rhinoceros leptorhinus*, and of other animals. The plants found therein singularly agree with those found in the buried forest of Cromer.”

In page 216, a list of plants and seeds of the forest trees is given, and he remarks : “There are no less than three kinds of elephants, a rhinoceros, hippopotamus, a large extinct beaver, and several large esturian and marine mammalia, such as the walrus, *narwhal*, and *whale*.”

We have here the opinion of Sir Charles, that the remains of plants and mammalia, contained in the

* Page 315.

beds of the forest of Cromer, and those on the borders of the Lake Zurich, are *pre-glacial* and *cotemporaneous*.

At the close of the recent great glacial epoch, came a gradual abatement of the rigors of the wintry climate. With it came the re-emergence of the land. Slowly the saturated hills and valleys arose from the deep ; slowly grew the grass, the shrub, the plant, the tree : but England stood for ever thenceforth severed from the Continent. The waters of the British Channel now sweep along, and rush backwards and forwards at every tide, where long before the stately forest grew.

What was the fate of the mammoth and hippopotamus in the meantime ? Where were their bones ? Deep buried in the drift or in the cave where they had made their last retreat ; or where they had been carried by their destroyer, man ; or, sometimes, dragged there to be gnawed and notched by the teeth of the voracious hyæna.

France and England being separated after the re-emergence, neither the woolly elephant, the rhinoceros, hippopotamus, cave lion, nor bear, nor any other of the extinct animals (their cotemporaries), could have ever again revisited England. Their passage was cut off, their bridge was broken ; and if any of their species had by chance survived the rigors of the recent great glacial epoch and the concurrent submergence in France, they never could have crossed again the British Channel. Any of their remains now found in England, must have been pre-glacial.

Let us seek for them in the British caverns.

That at Brixham has been scientifically examined by Mr. Pengelly, of Torquay, and the position of every bone and relic carefully marked.

The mammoth, the hippopotamus, the rhinoceros *tichorhinus*, the *hyæna spelæa*, and other extinct races, had their habitation there. Abundant were their remains, their bones and exuviae ; but deep down, at the bottom of all, were found the flint knives, the barbed spears, and the rude ornaments of savage man.

Kent's Cavern next attracted the attention of geologists. A scientific exploration of it is still going on, under the eyes of Mr. Pengelly and Mr. Vivian. They state the succession of deposits in this cavern, so far as they have been excavated, to be :—first and uppermost, huge angular blocks of limestone ; second, black mould, from 3 inches to 1 foot in depth ; third, stalagmitic floor, varying in thickness from 3 inches to as many feet, but usually ranging from 12 to 18 inches ; fourth (the lowest as yet penetrated), red cave earth, with angular pieces of limestone, and occasionally rounded stones, not derivable from the cavern hill. The top black mould contained bones of many animals, several portions of a human skeleton, human teeth, and jawbones.

In the stalagmitic floor, amongst others, were found charcoal, flint flakes, and cores ; remains of various animals, including cave bear, fox, horse, and man. The human remains were a tooth and portions of the upper jaw, containing four teeth : they were deeply embedded in the floor of stalagmite, which was 20 inches thick. The black band below the stalagmitic floor included bones and teeth of

various animals, and traces of the presence of man. Among other animal remains, were those of the *rhinoceros tichorhinus* and *hyæna spelæa*. The indications of human existence are chips, flakes, cores, and implements of flint, bone tools, and bones partially burnt—the flint implements, 366 in number. The bone tools are two (perhaps three in number); one of them, an awl cut at one end to a sharp point; it was found beneath a floor of stalagmite 16 inches thick, perfectly intact and continuous in all directions. The second is a portion of a so-called harpoon, barbed on one side only, and about $3\frac{3}{4}$ inches long. The third is nondescript, and of doubtful character.

Rolled stones, not derivable from the cavern hill, occur here and there, in every part which has been explored

Blocks of stalagmite and remnants of an old floor continue to be abundant. They occur both in the cave earth and stalagmitic floor (which the committee found intact); and occasionally they project obliquely through the latter to the height of a foot or more. Many of them measure upwards of a cubic yard; one block measured fully three cubic yards.

Fragments of burnt bone have been found here and there in the cave earth, in every chamber and gallery.

The mammals represented are the cave bear, cave lion, cave hyæna, fox, horse, ox, several species of deer, the tichorhine rhinoceros, mammoth, and badger.

A considerable number of the bones have been gnawed; those found immediately under the heavy

blocks of limestone have been crushed—several are split longitudinally, in such manner as to betoken human agency.

The total number of artificially wrought flints found in the cavern during the last twelve months, is 834 ; of these, 238 are from the red cave earth, that is, the earth lowest down under the stalagmitic floor.

Two other bone implements have been found in the red cave earth below the black band. One is a portion of a highly-finished “ harpoon,” $2\frac{1}{4}$ quarter inches in length, and differing in form from that previously mentioned, being barbed on two sides, the barbs opposite, not alternate.

The second bone taken from the cave earth is a well-finished pin, $3\frac{1}{4}$ inches in length. It was found in the fourth foot level, below the stalagmite (the greatest depth to which the excavation has been carried), and in immediate contact with the crown of the molar of a rhinoceros.

Over this specimen there lay, in ascending order, four feet of cave earth, then the black band, over this the stalagmitic floor, 20 inches thick, perfectly intact, and continuous in all directions ; this was surmounted by the black mould ; and the whole was crowned with large blocks of limestone, cemented with carbonate of lime into a firm breccia, which reached the roof of the cavern. There was a remark of the committee, that the evidence which the last twelve months had put into their possession, rendered it impossible for any one to doubt that man occupied Devonshire when it was also

the home of the extinct lion, hyæna, bear, rhinoceros, and mammoth, and their cotemporaries.

This report is signed—

EDWARD VIVIAN.

WILLIAM PENGELLY,

CHARLES LYELL, Chairman.*

The authority for these statements is unquestionable. There were two previous reports from the commissioners, which I regret not having had an opportunity of reading, and I presume they adverted to a remarkable object in the cavern—a large cone or base of stalagmite, near the entrance of one of the chambers.

The stalactitic pillar, which formerly connected it with the roof, has been broken off for ages ; so long since had it been dissevered, that the wound (so to call it) was healed, the fracture smoothed over and rounded off by the stalactitic drop. It presented a fair and tempting surface for a visitor to record his presence. One person only (an Irishman) appears to have availed himself of the opportunity. Mr. Pengelly has kindly furnished me with a copy of the inscription, taken by the Rev. Mr. M'Eney in 1825: "Robert Hedges,† of Ireland, February 20, 1688."

The letters are now glazed over and partly effaced.

Mr. Pengelly adds, that this description, which is

* Since these pages were written, a fourth report has been laid by that committee before the British Association, at Norwich, 1868. This I have not seen.

† Mr. Pengelly reads the name Hedges.

still quite appropriate, establishes the genuineness of the inscription for upwards of forty years at least ; that he knows of no reason for doubting its right to be as ancient as it claims, but that he should be sorry to have any argument on the date, for it may be an anachronism.

Mr. Pengelly has no reason for doubting the ancient date. I think it bears upon its face the impress of truth. The stalagmite was, in its composition, exceedingly hard. The inscription could not have been made without trouble and difficulty. It was not the record of any political date, but merely the commemoration of the visit of an individual to a cavern, then attractive as a curiosity, now most interesting in a scientific point of view, from the buried objects it has furnished.

Had the inscription been made at any later period than it records, it is most likely some prominent historical fact would have been seized upon ; and there were many which followed shortly after, some of them in the following year, events of which any of them would have furnished him with a subject for commemoration. But no ; his object was merely to perpetuate his own visit to the cavern ; and the inscription of his name, his country, and the date, "20th February, 1688," have no farther signification than the simple record of his visit. I have full reliance upon the truthfulness of the date.

For one hundred and eighty years has this inscription remained, now somewhat effaced by the stalactitic drop. Does it not afford some guide as to the slow rate at which the deposit accumulates ? The scratches of the inscription had first to be filled up ;

the drops of water would naturally run into the hollowed letters, and cause a thickening sooner than on the adjacent surface ; and yet, after a lapse of nearly two centuries, the deposit has not increased the sixteenth part of an inch. Forty years ago, the Rev. Mr. M'Enery wrote :

“ The letters are glazed over, and nearly effaced.”

Forty years after, Mr. Pengelly writes :

“ This description is still quite appropriate.” So that the inscription yet remains, though nearly illegible.

How stand the facts ?

There was a time when man inhabited the cave cotemporaneous with the mammoth—a time at which there was no water dropping from the roof, at which his bed was dry, his barbed spears at hand, and his ornaments—the very pin to fasten the skin-cloak he had torn from the back of some savage beast—was there. The debris and the floor of his den accumulated by slow degrees to the depth of *four feet*—here a bone of a mammoth, there the tooth or skull of a rhinoceros. At length there came an advance of civilization, and man enjoyed the luxury of a fire ; he roasted the flesh and charred the bones, and left a deposit of black earth to the depth of six inches.

Another change occurred. The ground above the cavern (and all the surrounding country) became deeply buried in snow and ice ; the cavern was sealed up ; the land sank down beneath the surface of the ocean, and the cavern was closed—covered with water, untenanted. The land at length emerged from the deep water, percolated through the solid

rock above ; drop by drop it fell, carrying with it a lime deposit : a floor of stalagmite was formed. In the course of ages, that floor became broken up—how we cannot ever know ; the formation of a second floor commenced, drop by drop ; again it formed, including in its *stony fold* the debris and disrupted fragments of the former floor, until it reached to the depth of from 16 inches to 2 feet. Great masses of the roof fell down. Man, once more in possession, took advantage of the scattered blocks ; he piled them up until they reached the roof and barred the entrance to the inner recesses of the cave, but left a hole through which he himself could creep. Ages passed on ; the dropping stalagmite cemented the piled-up wall together, and formed a compact building of concrete breccia to the roof : great stalactites were forming in other parts of the cavern, extending from the roof to the floor. Of their pillars, none are now extant ; but the bases or blocks of some, as yet remain to testify to their former magnitude. The original height of one of these was about ten feet from the floor to the top of the cavern, the body of the pillar had been long since broken off, and carried away—the base remaining is four feet in height—the stem must have been of great dimensions. Picture to yourselves an ancient oak, knotted and gnarled, the growth of many centuries, the stem eight feet in diameter by ten feet and a-half, rising to the roof of the cave, and you may form a good idea of the size and shape of this stalactitic pillar. This was only one (and not the largest) of many, contained within the cavern. Thus, by the two stalagmitic floors—the piled up wall—its conversion

into a concrete breccia, and lastly, by the formation of those enormous *stalactitic* pillars on top of the floors, were the relics of the ancient inhabitants of the cave sealed up, and their remains preserved through thousands of years, to testify to the existence of pre-Adamite animals and man. The pillar being broken down, its wound, as I have mentioned, in course of time healed over, the surface rounded off by the constant drop. The Irishman there graved his name, and that inscription yet remains to prove how tardily that massive pillar must have been formed drop by drop. Black mould again has covered up the stalagmitic floor, and in it bones are found ; none of the mammoth, or of other extinct creations ; they lie buried underneath that floor of stalagmite, and below the basement of that massive pillar. But, in the clay, upon the surface of that floor, the bones and relics of modern animals, such as are existing at the present day, lie scattered ; remembering, however, that since the re-emergence of England, the British Channel has existed between England and France, that the pathway of the wild beast between the two countries has been thus cut off, that all animal life in England had most likely perished during the glacial period and submergence, how can the presence of the mammoth, rhinoceros, cave bear, hyæna, and especially the *hippopotamus* be accounted for in England, if they were of the post-glacial period ? how easily and naturally, if pre-glacial. I have before endeavoured to account for recent shells being found along with the bones of some of those animals ; the bone beds having been cut through by rivers and streams,

and the recent shells deposited among the ancient relics.

If this were not so, and that all was post-glacial, how did the mammoth and his cotemporaries cross the British Channel. How did the *hippopotamus*, a denizen of a warm climate, exist here, in post-glacial times, in a temperature so low and cold as the present? We feel reluctant to admit so vast a period for the existence of the human race. The leaning of the educated mind of man is towards the time of Adam; he has been so taught from boyhood. This can be clung to no longer. Tardily and unwillingly, we seek an earlier date for man. We stand aghast at the thoughts of a few thousand years beyond the time of Adam; and yet geology is driving us back, and back, and farther into the mist of ages and of eras. But why should we try to set bounds to time, which has all eternity to revolve in? What are a few thousand years compared to eternity? What are many millions?

We have a concise description of time by an illustrious poet :

“ A narrow isthmus ’twixt two boundless seas—
The past, the future—two eternities.”

CHAPTER X.

CLOSE OF THE SIXTH AND BEGINNING OF THE SEVENTH DAY OF THE HEXAÆMERON.

The Tradition.

THE creation of Adam was inaugurated with great solemnity. The vast zodiacal cycle of nearly 21,000 years had performed one of its grand revolutions ; it had brought to a close once more a prolonged and ancient era, and was prepared to commence anew. In setting forth again from its zero point, it was to be accompanied by the several kinds of time before mentioned, with their astronomical accompaniments, calculated by Mr. Gresswell to have revolved to the same node after a lapse of 516,000 years. All having thus united in the year 4,004 B.C., were again setting forth together on their respective circuits, at which time, at the vernal equinox, in that year* (according to the received authorities), was the creation of Adam. With him commenced the present efflux of time.

In the 1st chapter of Genesis, Moses has given us an account of the creation of the earth, and particularly that of mankind on the sixth day, as revealed to him by the Great Creator. In the 2nd chapter, he has given a detail of the creation of a particular man, his being placed in the garden, his fall ; and the events which occurred from thence to

* Sir John Herschell's "Outlines of Astronomy," p. 235.

the time of Moses, can only be looked upon as an account of a particular family, handed down by tradition through Adam and his descendants.

It may be fairly presumed that Moses collected the traditionary fragments and preserved them, forming them into a continuous narrative.

As recorded in the 28th and 29th verses of the 1st chapter, God had given to man, male and female of the revelation (that is, to mankind), dominion over fish and fowl, and “every living thing that moveth on the earth;” also every herb and plant for his use, without restriction or reservation—“To you it shall be for food.” Man was abundantly supplied with food in his early savage state. He supported himself by hunting and fishing, and by fruits and roots, as all aboriginal savage nations yet do. In that state there is no inclination to labour, neither had he been *appointed* to till the ground. He was not restricted to any particular domicile ; he could hunt over the whole face of the earth, and he was to be fruitful and multiply, and replenish the earth.

Adam appears to have been specially formed, specially gifted, specially cared for, specially restricted.

Chapter ii, verse 7.—“And the Lord God formed Adam of the dust of the ground, and *breathed into his nostrils the breath of life*, and Adam became a *living soul*.”

It is not stated that the male and female of the revelation, mentioned in the 1st chapter, became living souls. We must not infer from this that pre-Adamite man is beyond the pale of salvation. He

was, probably, in the same state as Adam became after his fall. But this is a subject full of mystery and difficulty, into which we are not here called upon to enter. Adam received a peculiar gift—a *living soul*; the integrity of which he was to lose in case of disobedience.

8th verse—"And the Lord God planted a garden *eastward* in Eden, and there he put the man he had formed." (Observe, Adam was created single.)

Verses 10 to 14 defines the boundary of the garden, as if to shut off Adam from the outer world.

15th to 17th verse.—"He put him into the garden, to dress and keep it" (or till it). This was a special duty put upon Adam—to cultivate the soil. He was not to lead a savage life, and wander about the world, hunting and fishing for subsistence, as were the plural "male and female," who had got dominion over the earth, to replenish and subdue it.

Adam was confined to a limited district—"Of every tree of the garden thou mayest freely eat, but of the tree of knowledge of good and evil thou shalt not eat; for in the day thou eatest thereof, thou shalt surely die." Adam disobeyed; he lost the integrity of his living soul; and it may be that thenceforth he was placed on an equality with the other inhabitants of the earth, though with a shadowed promise of future restoration.

To the plural mankind of the revelation "male and female," God gave permission to *eat of every tree*—"To you it shall be for meat." But to Adam he says: "Thou shalt not eat of the tree of knowledge of good and evil."

There is here a clear distinction made between the

plural of the revelation "*male and female*," who might partake of every kind of food, and roam over the whole earth, and Adam, created singly, who was restricted in his food, and confined to live within a *pecially* defined district.

At that time Eve had not been formed ; years may have elapsed before her appearance. Adam had a language, and had previously made use of it by giving names to the beasts of the field and fowls of the air. For Eve there was also a special creation : this, again, is different from the creation of *male and female* of the revelation.

Chapter 4.—After Cain had killed Abel, and when his doom had been pronounced : "A fugitive and a vagabond shalt thou be on the earth," he replies : "Behold thou hast driven me out this day *from the face of the earth*, and from thy face *shall I be hid*; and I shall be a fugitive and a vagabond *in the earth*; and it shall come to pass, *that every one that findeth me shall slay me.*"

This is a most remarkable passage. Had there then only been on the earth, Adam, Eve, and Cain, who was there to kill him except his father and mother ? who was the *every one* he was afraid of ? Does it not plainly point to other families and inhabitants then *in the earth*, besides Adam and Eve ? Cain also appears to draw a distinction between *the face of the earth*, where he was in communion with his Creator and with his parents, from whence he was to be driven, and the place he calls "*in the earth*," where he was to be a fugitive and wanderer among strangers, hidden from the face of his Creator,

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and where he was apprehensive that those strange people might kill him.

15th verse.—“And the Lord said, *Whosoever* slayeth Cain, vengeance shall be taken on him sevenfold. And the Lord set a mark on Cain, lest any finding him should kill him.” The “*whosoever* slayeth Cain,” and the words “*lest any finding him should kill him*” must have reference to others besides Adam and Eve.

16th verse.—“And Cain went out from the presence of the Lord, and dwelt in the land of Nod.” Does not this imply other lands and other inhabitants ?

“And Cain knew his wife, and she conceived and bare Enoch.” Where did he get his wife, if there was only Adam, Eve, and himself then living ? He had no sisters ; he was driven forth a vagabond and a fugitive ; he was driven from his family—from Adam and Eve—no one accompanied him. Did he not get his wife in the land of Nod ?

“And he builded a city”!! Where did he get workmen to build the city ? or where did he get inhabitants for it ?

20th verse.—“And Adah bare Jabal : he was the father of such as dwell in tents, and *of such as have cattle.*” Moses spoke of the descendants of Jabal as then existing, and then dwelling in tents and having cattle.

21st verse.—His brother’s name was Jabal, “the father of all such *as handle* the harp and organ.” Again he speaks of existing descendants.

22nd verse.—And Zillah bare Tubal Cain, “an instructor of every artificer in brass and iron.”

None of these were in the ark, nor were their descendants, and yet Moses spoke of their descendants as then living.

It is now generally admitted that the deluge was local, caused by a temporary depression of the district in which Noah resided ; that Noah only described the scene of the flood as it appeared to him. The gradual submergence of the land would not, to his eyes, have had the appearance of sinking ; it may have been gradually subsiding for centuries before. The waters would have appeared to come surging over the ground, and rising over the tops of the neighbouring hills, until he could see them no longer. He would have naturally transmitted to his posterity the account of (as he supposed) the submergence of the whole human race, except those with him in the ark. He was borne away to a distant land, where he went forth from the ark with his family.

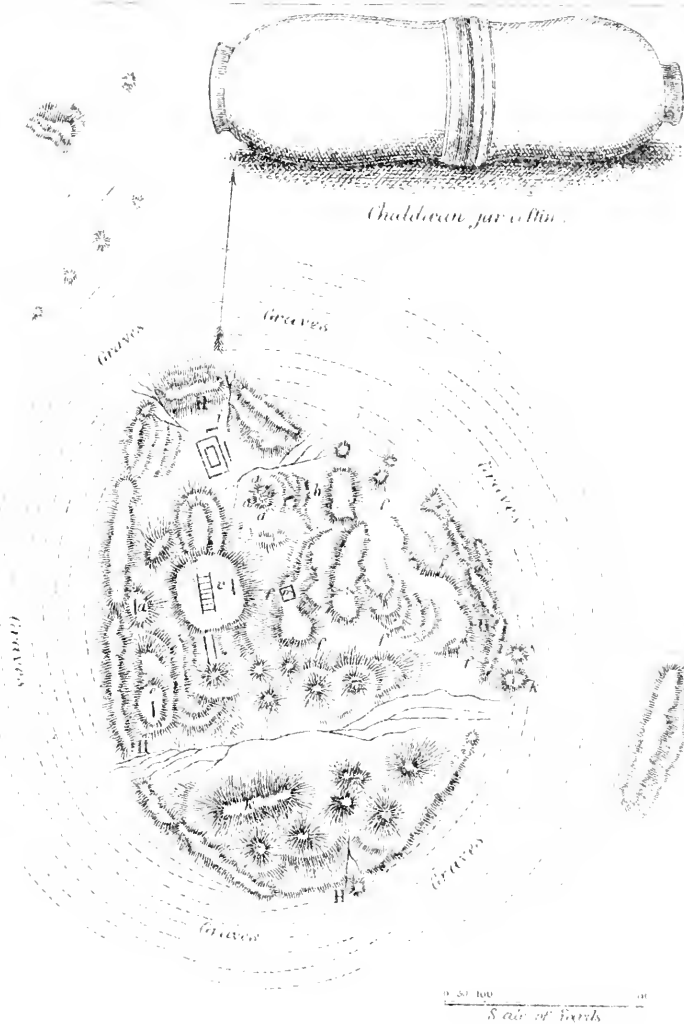
If the flood had been universal, in what state would Noah have found the earth on his debarkation ? Forests uprooted, rocks laid bare, all productive earth swept away, all animal life destroyed ; and Noah would have landed on a wet, slimy, cold, rocky, surface, without fruit, root, or food—without the means of raising grain, or clay on which to plant or sow his seeds. Yet, what do we find ? He began to be a husbandman ; he planted a vineyard and made wine. Where did he get the vines to plant, or tools to dig the ground ? So far from the earth being bare, and barren, and desolate, we would rather infer that the ark had been specially directed to a fertile country—to one suitable for Noah's resi-

dence. He appears to have remained there for about one hundred years, and then to have immigrated to, and settled in, a populous country—one greatly advanced in civilization.

What was the state of the country towards the Persian Gulf about that time? One of the earliest cities mentioned in Scripture was Ur or Hur of the Chaldees.* It was situate on the River Euphrates. It had, before the days of Abraham, and possibly even in those of Noah, a regular established government, and had made considerable advances in arts and sciences. The inhabitants wore woven dresses, ornamented with fringe and embroidery. They had signet cylinders, engraved on hard stone, by which the king and other great people ratified their documents and enjoined their commands. They must have had engravers to cut those cylinders; they had a written language, which had already passed out of the hieroglyphic stage, and entered into the transition, when pictures are no longer adopted; they graved their history on stone, and impressed it on burnt bricks and pottery.† Astronomy had been studied, and a series of observations made, long before this period. Connected with Ur was the Necropolis of Mugheir, the centre of which was an ellipse of about a mile and a-half in circumference, containing a great temple and well-built tombs. Outside of that boundary, and all around for a circle of about 400 yards in breadth, was devoted to the purposes of burial, and contained graves innumerable, and coffins of burnt clay. Rawlinson states that the

* Rawlinson's "Ancient Monarchies," vol. i. p. 2.

† Ibid. p. 202.



Plan of Mugheir Ruins.

H H H H. 2940 yards round.

a. Platform on which the house a is built.

a. House located

b. Pavement at edge of platform a, 12 feet below surface.

c. Tomb mound.

d, e, a, k, l, m. Points at which excavations were made by Mr. Loftis.

f, g, h. Comparatively open space of a low mound.

quantity of human relics accumulated upon certain Chaldean sites is enormous, and seems quite beyond what the mere population of the surrounding district could furnish. He instances Warkah, where, except the triangular interval between the three principal ruins, the whole space within the walls, and an unknown extent of desert beyond them, are everywhere filled with human bones and sepulchres—coffins, he states, piled upon coffins, certainly to the depth of *thirty*, and probably to the depth of *sixty feet*.^{*} For miles on each side of the ruins the traveller walks upon a soil teeming with the relics of ancient races ; yet Moses does not enter into any particulars about the wonderful works of the Chaldees, and merely mentions Ur incidentally, in tracing the movements of Abraham, of his father Terah, and of his brother Haran, who was born and died in *Ur of the Chaldees*.

Moses was brought up at the court of Pharaoh, and was skilled in all the learning of the Egyptians. He could have given to the world a history of the dynasties of the several kings of Egypt, from the commencement of the nation. He could have told of their mighty works, of their great pyramids, their temples, their cities, their obelisks and monuments, of their catacombs and great burying-places ; but to none of these does he refer. There lay a task before him. There was one great object, to the fulfilment of which he was divinely appointed, and to which he devoted himself—to rescue the descendants of Abraham from bondage ; to preserve them from

^{*} Rawlinson, vol. i. p. 107.

the temptations of idolatrous nations; to keep them in the knowledge and worship of the living God. Their kingdom was to be preserved until the coming of our Saviour, "in the fulness of time," for the ultimate salvation of all mankind, for the restoration of the "living soul" forfeited by the disobedience of Adam ; that every one on earth might again have the privilege of exclaiming with Job, "I know that my Redeemer liveth."

In writing the history of this nation, and in tracing its descent from Adam, Moses did not digress ; neither was he discursive about the origin or affairs of other nations, or peoples, or their historical facts, farther than was absolutely necessary for the accomplishment of the object to which he was appointed.

The Chaldeans carried back their mythic traditions to 34,000 years before Christ ;* the historical extend to 2,458 B.C. The Egyptians and Chinese reckon back many dynasties ruling in their respective nations before the time of Adam. The Egyptians reckoned several dynasties of kings of Egypt before the days of Menes ; and, according to Syncellus, Menes reigned 3,892 years before the Christian era. Some of these pretensions have been treated as mythical ; yet the innumerable masses of human relics remaining about Mugheir, Warkah, and many other Chaldean sites, would seem to point to periods extending back far beyond the reach of history.

Rawlinson† states that the antiquity of civilization of the Valley of the Nile, preceded, by many centuries, that even of primitive Chaldea, which he

* Rawlinson, vol. i. p. 193.

† Ibid. p. 68.

holds as one argument that migration has been from East Africa, by way of Arabia, to the Valley of the Euphrates.

The Duke of Argyll, in "Recent Speculations on Primeval Man," states "that the most moderate calculation carries the foundation of the Egyptian monarchy as far back as 700 years before the visit of Abraham ; and that some of the best German scholars hold there is evidence of a much longer chronology." The 700 years (which is the estimate of Mr. R. Stuart Poole, of the British Museum, pronounced by the Duke to be one of the very highest authorities on *Egyptian chronology*) would take us back to 400 years before the Noachian deluge. The Duke remarks that the founding of a monarchy is not the beginning of a race, and that the people amongst whom such monarchies arose must have *grown and gathered* during many generations. He says the *authentic* records of the Chinese Empire are said to begin in the twenty-fourth century before Christ, that is, 300 years before the time of Abraham ; that these records began apparently with a kingdom, having already an established form of government. The great pyramid of Geezeh could only have been erected by a multitudinous people of a great and long-established nation, and under the sway of a mighty monarch ; millions of people must have been engaged in the building. Some have calculated that pyramid to have been erected before the deluge ; others, at the latest, place it about 300 years after.

If any of us were now to make out genealogical tables for 300 years back of our own or of other families, and to trace our genealogical trees with all

their branches, so as to ascertain the present number of descendants of any one family that have arisen within that period, how far short would they be from forming a great or numerous nation, or such as could erect a building equal to that pyramid, the loftiest architectural production in the world !

Yet, its great height and bulk are, according to the Astronomer Royal of Scotland (Mr. Piazzzi Smyth), only a small part of its merits.

If his views be correct, the framers of the plan of that building must have been in advance of the learning of the present day. In its scientific construction, it shadows forth the size and weight of the earth ; the time of its revolution round and its distance from the sun ; unfolds a system of meteorology based on the earth's polar axis ; gives the mean density of the material substance of the earth ; and affords a base for measurement of the mean temperature of its surface. This view has been contested. Without taking into account what great advance must have been made in civilization and in the sciences and arts, when this and several other early Egyptian, Chaldean, Assyrian, and Babylonian buildings were constructed, what must then have been the density of the population of those parts of the earth ? From the account given in the book of Genesis of the family to which Abraham belonged, it is manifest that there were settled kingdoms existing in the time of Noah—Urkh, or Uruk, reigned in Ur and Kingi Accad. As testified by his history inscribed on the bricks of his buildings, he is called the king of the *four races or four tongues*.

Rawlinson says:* The basement platform of all the most ancient buildings throughout the entire region are his works. He is thought to be the first monarch of whom any remains have been obtained—that his bricks are found in a lower position than any others; that they are rude, coarse, and unburnt; that the inscriptions upon them, in their simplicity, contrast with the more elaborate and complicated symbols of later monarchs; that the basements of his buildings are enormous, indicating the employment for many years of a vast amount of human labour.

Rawlinson states of the mound at Warkah, that its cubic contents could have been little under 3,000,000 of feet, and that above 30,000,000 of bricks were used in its construction; the temples were carefully built, with their angles facing the cardinal points; the use of buttresses was understood, and the importance of sloping the walls inwards to resist pressure was recognized, and drains were introduced to carry off moisture.

This building at Warkah was only one of Uruk's many buildings and temples. He had founded other cities, and built temples to several gods.

How populous must have been that nation to have erected such stupendous buildings; yet, some of these were made shortly after the time of the flood. Terah, the father of Abraham, resided in Ur during the latter part of the lifetime of Noah, and Haran, the brother of Abraham, was born and died there, and probably Abraham himself (two years after the death of Noah) was born in Ur of the Chaldees.

* Vol. i. pp. 198-9.

The Duke of Argyll reminds us there is no absolute proof that a change from white to negro blackness is possible, and refers to a very able but anonymous work, where it is maintained that Adam was progenitor of the white races only, and that before the creation of Adam the black race had been established in Africa. He alludes to the intimation in Genesis of other races of man besides Adamites (as Mr. M'Causland has also done in his "Adam and the Adamite"), where unions are referred to between the sons of God, or, as the true meaning of the original is by him contended to be, "the servants of the gods" (that is, the idolatrous races) and the daughters of the Adamite. In the 6th chapter of Genesis, 2nd verse, whether we read it the sons of God saw the daughters of men, or "the servants of the gods saw the daughters of the Adamite that they were fair, and they took them wives of all they chose,"* the passages equally point to different races. Is not the expression "fair" remarkable. If the only race then existing was of Adam, the daughters would have been all of fair complexion. There must have been some reason for drawing a distinction. The sons of God (or the servants of the gods) admired the daughters of men, because they were fair; might we not infer that their own daughters were dark, or even black? The taking of

* Even after the deluge, worshippers of the several gods were called their servants. For instance, the name of King Chedor Laomer (who, with four other kings, made an expedition into Syria in the days of Abraham, and defeated the five kings in the Vale of Siddim), imports that he was Chedor, the *servant of* Laomer or Lagamer, a Susianian god.—Rawlinson's "Ancient Monarchies," note 5, p. 206.

all they chose for wives, would intimate that the captors were of a more powerful race than the captives—that the wives were taken by force. But the 4th verse points to a still more powerful race than either—“There were giants in those days.” These are quite distinct from the sons of God. The tradition continues : “ And also, *after that*, when the sons of God (or servants of the gods) came in unto the daughters of men, and they bear children to them, the same became mighty men, which were of old men of renown.” Here, then, is a direct pointing out of four races of mankind before the flood : first, the Adamites ; second, the servants of the gods ; third, the giants, or a larger race of men than either ; and fourth, the mixed race, arising from the intercourse of the servants of the gods and the daughters of the Adamite. Recollect, that one of the titles of Uruk, king of Ur, was king of the four races or four tongues.

But to return to Noah and his family. After debarkation in a land where they cultivated the ground, and planted vineyards, and resided, having their own vines, and drinking their own wine, by the Scriptural account the time appears to have been about 100 years, or A.M. 1758. According to the 9th chapter of Genesis, 1st verse : “ The whole earth was then of one language and of one speech,” that is, Noah and his family were.

They departed from the place of their debarkation, and from the vineyards they had planted.

2nd verse.—“ As they journeyed *from the east*, they found a plain in the land of Shinar, and they dwelt there.”

3rd verse.—“Let us make brick, and *burn them thoroughly.*” (Observe, the bricks of Ur were rude and unburnt.)

4th verse.—“Let us build a city and a tower.” They had, perhaps, seen the buildings of the Chaldeans, and were tempted to emulate them ; but their numbers must have been deficient. Deducting the aged and infirm, and the women and children, from the descendants of Noah, the workmen remaining must have been then but few, and quite inadequate to the building of a city and a tower ; neither could those few have all been given up for the purpose of building—some must have sown and reaped and planted, others must have been occupied in the chase, and in procuring subsistence for the builders and for their families. It is, therefore, likely they endeavoured to employ the aborigines to assist them ; but, as the Bible states, “*they did not understand one another’s speech,*” and they left off to build a city.

It is not intended in the slightest degree to impugn the traditional account of these early proceedings of the Noachites, as given in the Bible. M’Causland, in his “Adam and the Adamite,”* truly remarks, in reference to the Bible, that we may not fully understand the exact meaning of all we find in that book ; that the language in which it

* M’Causland, in that work, has fully entered into the subject of pre-Adamite and subsequent races of man ; has discussed the subject in a geological, archaeological, ethnological, Scriptural, and historical point of view ; has dissected the several languages known to have been spoken within the historical periods of mankind ; and has put forward convincing arguments, showing that Adam was not the first of the human race.

is usually read, is not that in which it was written, but one that differs from it materially, both in vocabulary and structure; that, between the original and the translation, there are frequent and material diversities, which may vary considerably the expression of what was in the mind of the author.

Noah resided in the land of Shinar for 248 years, until the time of his death, in the year A.M. 2006, that is, two years before the birth of Abram. This was sufficiently long for himself and family to have learned the language of the aborigines, of the Chaldeans, and other neighbouring nations. Ashur, his grandson, went forth out of *that land*, and builded Nineveh, and Rehoboth, and Calah, and Resen—"the same is a great city;" and Nimrod founded Babel, and Erech, and Accad, and Calneh, in the land of Shinar.

It is manifest these eight cities could not have been built without assistance from the surrounding nations. The Noachites could not have then increased sufficiently in number to require so many cities; neither could they have built nor have peopled them with only their own race. By that time a great intercourse must have sprung up between the descendants of Noah and the aborigines, Chaldeans, Assyrians, and Egyptians—idolatrous nations. The race of Noah was soon led astray from the worship of their Creator; for we find, even perhaps during the lifetime of Noah himself, his grand-children erecting temples to the worship of Bel or Beltis, and other gods. The Chaldeans had numerous gods, all carefully mentioned in their inscriptions upon brick and stone; they had enormous temples raised to

the worship of these gods, but no mention on their bricks of the Almighty, by whom Noah and his family were preserved ; nor was any temple, memorial, or altar, erected to his worship by Noah, nor by any of his family, of which we have any record, previous to the time of Abraham, save the altar built after the coming out from the ark. And what were his works compared to those of surrounding nations ? He could only set up a few stones. Had the founders of these nations, and cities, and temples, been all descended from Noah, could they so soon have completely forgotten the Almighty, who had so signally preserved their race ? None of those temples were erected to His worship, nor do any of the bricks of their numerous buildings record the name of the Creator. Could the Chaldeans have been descended from Noah, and yet, even in his lifetime, have so totally forgotten their Creator ; whilst the descendants of Abraham have preserved His worship for 4,000 years, and to the present day ?

Since the day that Adam was placed in the garden *to till* and *cultivate* the earth, could his descendants, the civilized man, have degenerated into the savage ? Have we any instances of it ? On the other hand, how seldom does the savage approach civilization, or cultivate the ground ! Every effort has been made to reclaim him from his wild and aboriginal state, but without much effect. In America, lands were given to the Redskins ; schools, chapels, saw-mills, and houses built for them ; they were furnished with ploughs, corn, seed, fruit-trees, horses and oxen, poultry and pigs ; but they would not labour with

their hands to any purpose. A good harvest made them lazy and improvident ; a bad one thinned them by starvation and disease. One or two families, in whom there was a tinge of white blood, succeeded tolerably ; the rest only remained on the land so long as they could sell timber and game. Wood grew scarce ; game disappeared ; they sold the land, and moved off again into the wild country.*

In Western Australia, native children were taken and educated with the children of the whites. They were as apt in learning to read and write as the children of Europeans ; they were fed and clothed ; but as soon as they attained the age of puberty, their clothes were thrown aside, their lessons forgotten, and they betook themselves to savage life in the woods. We collect from a paper read by Mr. Dunn, in the "Transactions of the Ethnological Society," that the projection of the lower jaw of the Negro is not visible at birth, and does not take place until the period of puberty.

Whilst, in the white man, the gradual increase in the jaws and facial bones is not only equalled, but exceeded, by the development of the brain, the reverse takes place in the Negro ; his jaws become larger and larger, while his brain remains of juvenile dimensions.

The black child is not behind the white in intelligence ; but, after puberty, the same process takes place as in the ape—the intellectual faculty remains stationary, and the individual, as well as the race, seems incapable of farther progress.

* Dixon's "New America," page 109.

CHAPTER XI.

OVERPEOPLING THE EARTH.

It has been objected, that had the earth been peopled as early as geologists assert, it would long ere this have been so crowded with population, as to render the support of all impossible.

Had the earth been teeming with population during the pliocene ages, that population would have been totally destroyed within forty or fifty degrees of the north pole, by the submergence which occurred during the glacial period, and from the rigorous cold which then buried the mountain tops of the unsubmerged districts in snow and ice.

Had that epoch not occurred, there would have yet remained a sufficient succession of calamities to have checked and prevented over-population. There were storms, and floods, and fires, droughts, plagues, volcanoes and earthquakes, and wild beasts.

Wars were always prevalent, particularly among savage nations. In their "struggle for life," they would not have submitted to starvation so long as they could exterminate and devour the neighbouring tribes. The normal state of savage tribes is that of perpetual warfare.

Take Genghis Khan, with his 14,000,000 of victims, as a sample of what a savage conqueror could do towards the extermination of races.

How many kinds of plagues and diseases are constantly going their rounds, and thinning off redundant populations? Look to the great plague in London, in 1664, where the inhabitants were cut off at the rate of 12,000 a-week, and where 4,000 people died in one night in that city alone. Catastrophes of this nature have been going on from the earliest recorded times until the present. In the days of Jacob, "the famine was sore in the land:" how many must then have perished in the countries around Egypt, of those who had no Joseph to replenish their sacks? From that time until our own, has the famine frequently been "sore in many lands." As a type, let the late destruction of life in Orissa testify. If millions in civilized countries have wasted off the face of the earth for lack of food, how must the savage have frequently fared, who had no stores of pulse or of grain—no cultivated roots, fruits, or vegetables—no domesticated flocks or herds to fall back upon in the time of famine, when, perhaps, his whole tribe was driven away from the hunting grounds, or the wild animals on which he had subsisted were cut off by forest or prairie fires, or by drought? Savage tribes were in a state of perpetual warfare; in times of famine, their ready resource being in the destruction of hostile tribes for food, or in the slaughter of each other.

Australia is a sparsely populated country. Why is it so? A fine climate, fertile soil, no ferocious wild beasts to contend with; the kangaroo and other inoffensive marsupials abound; the emu, the swan, duck, and pigeon, for their food,—and yet they have not increased and multiplied. Why is

this? A gentleman, who had been for many years in Australia, inquired of an intelligent native: "Weenat, before we came out here, did you kill each other as you do now?" "Plenty, plenty more; but you do not let us kill any now," was the reply. "Well, Weenat, what was the reason you killed each other?" "If we did not, we should not have had enough to eat." (They were not cannibals.) The reply of Weenat would hold good through all savage nations, who have never learned to cultivate the ground, who have no fixed habitations, no crops, no domesticated fowl or animals to resort to.

Among the American Indians, when a tribe runs short of food, "the hunter's remedy is to march against his neighbour, and, by means of his bow and tomahawk, create a fresh balance between the mouths to be fed, and the quantity of buffalo and elk which may be found to feed them."*

Besides the wars of tribes in Australia, they have their constant private feuds. One of the tribe A kills one of the tribe of B (whether by accident or design it matters not). The nearest male relative of the murdered or deceased man is bound to avenge the death; this he does by killing any male of the tribe of A, whose relative, in return, becomes the avenger. Thus it continues, death for death, until the feud is nearly exhausted. A woman is then slaughtered by one tribe, a girl in return by the other; and thus the strife gradually dies out, and so is ended.

It is a circumstance worthy of remark, with respect to the inhabitants of Australia, that they have

* Dixon's "New America," page 118.

no knowledge of the use of the bow and arrow—a necessary, one would say, for those leading a savage life. Had they ever known the use of these arms, it is unlikely they would have lost the knowledge of such instruments of destruction,—weapons in daily use among almost all savage tribes, known extensively, and anciently used by men cotemporary with extinct mammalia, as appears from the quantities of flint arrowheads found in the drift; and yet these Australian savages had (at the time of their discovery) a weapon unknown to, and unused by, the inhabitants of any other country in the world—the boomerang. This shows a separation from and want of connexion with the other races of mankind.

Some people still maintain that the Negro and all other races of man, be their colour what it may, are descended from Adam, and that the difference of colour arises either from the effects of climate, or from some chance varieties being continued. But what are we to say to the Negro and other existing races not having changed in form, feature, or colour, since they were painted or sculptured in Nineveh and Egypt, 4,000 years ago, and shortly after the flood? Well might the prophet Jeremiah exclaim: “Can the Ethiopian change his skin, or the leopard his spots?” The colour of the Negro remains as he came from the hands of the Creator, unchanged and unchangeable. The descendants of Adam were fair, those of Noah were fair, the Chaldeans, the Babylonians, the Ninevites and Assyrians, Medes and Persians, were fair. Whence, then, comes the Negro, if not pre-Adamite?

Should it hereafter appear, from further researches

and discovery of other human remains embedded in such matrix, as to prove, beyond all question or doubt, that man had existed for thousands of years before the creation of Adam ; still, it is submitted, there would be no conflict between that fact and the description of the creation of mankind, as given by Moses, in the 1st chapter of Genesis, and the creation of Adam, as in the 2nd. Such creations may have occurred at different periods, during the long protracted cycle of the sixth day.

Again, that the traditional account given by Moses of the creation of Adam, would not be inconsistent with the fact of many other races of man having existed on the earth, as well before as at and after the time of Adam's appearance upon it.

And lastly, though there may have been many pre-Adamite races, and mixed races with Adamite blood, existing on the earth, at and after the time of the flood, exclusive of Noah and his family, and not included in the ark ; yet, that the traditional account of the deluge, handed down by Noah, was to him, and in his eyes, and in his metaphorical language, strictly correct. The country he dwelt in was all the world to him. The tops of the hills he was acquainted with, and accustomed to look upon, were to him the highest mountains in the world ; and when he witnessed the overwhelming of all the people that he knew of by the flood, the waters rising until his boundary hills were covered, and himself and family floated away in the ark, to some, to him, unknown country ; his relatives and friends—those who were the whole world in his eyes—swept away by the flood ;—would not his account of

the effects of the deluge have been to him, and in his metaphorical mode of speaking, correct ?

See the vast difference between Adam and his descendants, and those of the savage tribes. Adam soon discovered that he was naked, and got clad. He turned to labour, and “dressed and kept his garden.” His first-born adopted agriculture, and was a tiller of the ground. He migrated to other lands, and built a city. Abel was a shepherd, and tended his flocks. Jabel dwelt in tents, and had cattle. Jubal played upon the harp and organ. Tubal Cain worked in brass and iron. Noah builded his ark. After the flood he was a husbandman, planted a vineyard, and made wine. The great pyramid of Gheeza was erected either before or about the time of the flood. The Chaldeans, as before stated, had an established form of government; had made considerable progress in sciences, arts, and manufactures; had made a series of astronomical observations; and had a written language, before the founding of Ur of the Chaldees.

Let us now turn to the savage races—the pre-Adamites as we may call them—the people of the revelation, “*male and female.*” Were they appointed to till the ground? Moses does not state so. We cannot say decidedly that they were not clad, that they did not till the ground; we can only guess from the scanty information afforded by such of their relics as have as yet been discovered. These lead to the conclusion that their days were spent in the chase, and in the fabrication of their stone hatchets and hammers, of their arrowheads and knives of flint. They did not work in iron or brass,

nor did they build cities; they lived and died in their age of stone, as have many savage nations, and as many (perhaps their descendants) are doing to this day. We find among these, nations that are wild and untameable, unhoused, unclad, without agriculture, living in the rudest state of barbarity, and unable to count even the number of their fingers. What advances in civilization have the Blackfeet Indians of North America made? or the Sioux? or Camanches? or the several other savage tribes upon that continent? What has been the progress of the Australian, and of many of the wild tribes of Africa?

We are led to infer that there were several nations on the earth in the days of Abraham beside the descendants of Noah: some had made great progress in civilization, others were half civilized, half savage. Whence come they, or from what stock derived? We have before alluded to mixed races—the sons of God taking wives of the daughters of men, and their offspring becoming men of renown. They united the intellect of the Adamite, with the bodily strength, vigour, and craftiness, of the other races.

There is a wide field for the investigation yet before us, but we need not dread to enter into it, lest our discoveries should shake our faith. The Almighty has given us in the Holy Scriptures all the information necessary for our salvation, but He has not forbidden us to search into, and investigate, and admire His wondrous works. Our Saviour could have told us of the millions of suns in the heavens, and of their attendant systems of worlds, but He did not interfere with the contracted ideas or preconceived notions

of the world, farther than by stating, that in His Father's house there were many mansions.

If we meet with what is apparently contradictory or beyond our comprehension, we must patiently await elucidation, in the full assurance that the works of the Almighty will be found in perfect accordance with His Word.

RESUMÉ.

FROM what has been before stated, and from the last diagram, it would appear that the lower miocene commenced about 1,000,000 years, and the upper miocene about 825,000 years ago; that the upper miocene blended into the pliocene about 675,000, and the pliocene into the post-pliocene about 350,000 years since; that the post-pliocene *glacial epoch* gradually crept on about 350,000 years from the present time, and that it endured for 270,000 or 280,000 years; that the recent period succeeded about 50,000 years back, when the eccentricity of the orbit of the earth had contracted to 2,250,000 miles; and that the current period commenced nearly 6,000 years ago, that is, at the time of the creation of Adam;—

That the animals which we have called the extinct may have been placed in Europe and the north of Asia in the early stages of the pliocene formation;—

That they increased abundantly, and multiplied during the continuance of the pliocene times; that as the climate became more severe in the early part of the post-pliocene period, their numbers began to decrease;—

That the climate at length became intensely cold, while portions of the crust of the earth subsided, part

becoming submerged under the sea, and part being buried deep in snow ;—

That those extinct animals were, on the approach of the culmination of the glacial epoch, utterly destroyed ;—

That man (the fabricator of the palæolithic implements) was cotemporaneous with those extinct animals ;—

That, as the races of those animals became extinguished by the intense cold, and by being buried in snow and ice, palæolithic man, inhabiting the northern hemisphere, also yielded to the severity of the climate ;—

That, at the close of the post-pliocene glacial epoch, when the northern climate became milder, man, of the neolithic implements, found his way so far north as Denmark, and there made his home and hunting-ground on top of the glacial boulder drift ;—

That event occurred so shortly after the close of the glacial epoch, that neither the pine forests, nor the peats of Denmark, had then grown ;—

That afterwards lived the men of the “Kitchen Middens,” or shell heaps, and of the Pfahlbauten, or lake dwellings, and of the Crannoges, who continued to use their neolithic tools ;—

As civilization advanced, man began to cultivate cereals, to domesticate animals, and work with *copper*. Then came the discovery of *zinc and tin* ; and in the days of Adam, or his immediate descendants, came the working of implements of *brass*. *Bronze* also began to come into use. Iron was afterwards introduced ; and, by degrees, all civilized

nations adopted arms and implements of metal, whilst many savage nations have continued the use of arms and tools of bone and stone down to the present time.

The discoveries of a day might either confirm or upset the theory of pre-glacial man: the subject awaits farther inquiry.

In the Appendix will be found a number of questions put forward for geological investigation.

APPENDIX I.

The following points are here grouped and suggested, as deserving of, and requiring the further attention and consideration of geologists :

1. It being conceded that the varying eccentricity of the orbit of the earth was the chief cause of the *extreme* warm and cold cycles, it remains to be ascertained whether the submergence and re-emergence of the land in the northern hemisphere were, or were not, coincident with those cycles ; and whether they did not move *pari passu* together ?

2. Whether the period of culmination of the one was not also the time of culmination of the other ?

3. Whether the subsidence of the land was caused by the contraction of the rocks and of the plastic clays and granites, owing to the intense cold of the glacial epoch ; and whether the re-emergence was not the effect of their expansion during the warm periods ?

4. May not the valleys of the Somme and other rivers, in which remains of extinct animals were found, have been excavated down to the chalk and oolite, by the floods which followed the melting of the snows of the glacial epochs of the two miocene periods ?

5. May not the remains of the extinct animals have been deposited in the gravels lying on the chalk and oolite, previous to or in the early stage of the submergence, at the commencement of the post-pliocene glacial period ?

6. May not those remains have been covered over with some of the deposits found superincumbent upon them, prior to or during the early post-pliocene period, and afterwards have been capped by the glacial boulder clay ?

7. Those deposits having been subsequently cut through by

the flow of the present rivers, may not those remains have been again partially exposed, by having been, in some places, washed out of their ancient beds, and, in others, so sufficiently denuded as to render them discoverable, as at present?

8. Is the line S to R, on the first diagram, comprehending 276,000 years, properly placed for the commencement and ending of the cold period, beginning when the eccentricity of the earth's orbit was at 5,500,000 miles, and ending when it was at 2,250,000 miles?

9. Assuming the submergence to have been caused by intense cold, could there have been any continental period after the commencement of the post-pliocene glacial epoch? and, if so, at what time could it have occurred? or in what state of eccentricity of the earth's orbit, considering that, during 276,000 years, it never contracted sufficiently to admit of a warm period?

10. Could the several races of the extinct placental animals which inhabited Europe and the north of Asia before the post-pliocene era (the *cervus megaceros*, perhaps, excepted), have retreated to warmer climates, crossing the Pyrenees and Alps, the Caucasian, and the other mountain ranges, after the post-pliocene great glacial period had set in?

11. If they did so, is it likely that their several races would have returned to inhabit their former country after a lapse of about 270,000 years, at which time the climate again became ameliorated, and warmth increased to much the same temperature as at the present day, the northern portions of the earth having, in the intermediate time, remained frozen up and uninhabitable?

12. If they had so returned again, and if none of their races were missing after such a lapse of time, why should not those several races have continued to exist to the present day, in a climate moderate as it now is; or by what calamity could they, in such milder climate as succeeded the glacial epoch, have been all totally cut off, with their cotemporary, palæolithic man?

13. Sir John Lubbock states, that certain weapons mentioned by M. Bouchier de Perthes, in his "*Antiquités Celtiques*," cannot be confounded with those of a ruder structure from the drift gravel. The first were ground to a smooth

surface, with cutting edges, while the more ancient are only chipped; not one of the many hundred palæolithic weapons already found having shown the slightest trace of having been ground. He maintains that they are separated from the earlier weapons of the upper level drift by the whole period necessary for the excavation of the Somme Valley to the depth of more than 100 feet.

Sir John observes: "It seems to me that the upper level gravels are mere fragments of an originally almost continuous deposit;" . . . "as the valley became deeper and deeper the gravel would be deposited at lower and lower levels." . . .

"During these wanderings from one side of the valley to the other, the river continually undermined and removed the gravels, which, at an earlier period, it had deposited: thus, the upper level gravels are now only to be found here and there, as it were in patches."

When the upper level drift was undermined, is it not evident that it fell into the river, and that such of it as was heavy enough to continue there, without being swept away by the current, would have become lower level drift thenceforward?

With this in view, take Icklingham, in Suffolk (Valley of the Lark). Sir Charles Lyell came to the conclusion that the tool-bearing drift was newer than the glacial drift, *because it contained pebbles of basalt* and other rocks derived from that formation.* The chalk hill there is capped (like the oolite of Biddenham) by boulder clay: would not the same process hold good as at the Somme Valley, viz., as the river undermined the boulder clay, the pebbles and basalt it contained would have fallen into the lower level gravel, and have mixed with or covered the tool-bearing strata? Thus a portion of the tool-bearing gravel might be found to be older, instead of newer, than the boulder clay.

14. Let us take the formations at Mundsley and Hoxne, which, Sir Charles states, are similar. At Mundsley, the river has cut through the boulder drift, and deep into the forest bed, No. 3 and 3' (see his diagram, page 224), and the cut has been filled up by the formations marked A, B, C, D.† A (the

* Lyell's "Principles," tenth edition, vol. i. page 169.

† Lyell's "Antiquity," p. 224.

lowest) is composed of coarse gravel, B of a black peaty deposit, C of yellow sands, and D (lying on the top of all) of drift gravel. B would correspond with the peaty deposit of Hoxne (with No. 5, marked also B, in his diagram). In this peaty moss are fragments of wood, of oak, yew, and fir. This is evidently a reconstructed formation ; the trees did not grow where the fragments appear, but were carried there by the river. In the overlying deposits (No. 3 and 4) are found flint implements and bones of extinct mammalia. These, though lying over the peaty deposit, were of an older formation. How does this appear? Recollect the order of the formations in Denmark : 1st, boulder clay ; 2nd, flint implements of the neolithic type, older than the growth of the fir forests ; 3rd, the fir-trees and peat, with occasionally neolithic implements ; 4th, the oak, with bronze implements. It is admitted by all geologists, that the palæolithic implements were, in the point of age, long prior to the neolithic. The neolithic tools would (according to the Danish proof) have been of older date than the fir and oak. From these circumstances, the direct inference is, that the contents of the peaty deposit at Hoxne, containing fragments of fir and oak, were of later formation than the overlying deposit, in which the flint implements were found ; that both were reconstructed deposits ; that the peaty formation was first torn away by the river's flood, and deposited at Hoxne, where now found ; and that the tool-bearing deposit was afterwards torn away by the river, and left lying upon the peaty mud. This may not have been the case ; but, as it might have been so, it requires farther investigation.

15. If early man had to contend with a much colder climate than that which we now enjoy (as stated by both Sir Charles Lyell and Sir John Lubbock), how far back are we to search for such climate? 50,000 years ago, the orbit of the earth was only at an eccentricity of 2,250,000 miles ; the northern climate should have been then rather warmer than at present, when the eccentricity is at 3,000,000 of miles ; during that long period of 50,000 years, our climate should have been gradually growing slightly colder (not taking into account the variations of heat and cold caused by the "*great summers and long winters*," mentioned in Appendix No. 3).

About 60,000 years ago, the eccentricity was the same as at present (3,000,000 miles), and the climate should then have been much the same as now, but for the previous long-continued cold. Admit, however, that it was then colder; that the glacial boulder drift had been deposited before then, and that the climate had become so far ameliorated as to permit the growth of the fir-tree in Denmark; that would only take us back to the period of the neolithic implements. How much farther back must we seek for the palæolithic tools, and the extinct mammalia? The gap between the palæolithic and the neolithic must have been vast; and if it carries back to the post-pliocene glacial times; to the destruction of palæolithic man, and of the races of extinct mammalia; the enclosing of mammoths in mountains of ice is easily accounted for.

Lyell has fully established the fact, that the extinct animals were pre-glacial, and of the pliocene and post-pliocene periods; but he thinks their races survived to post-glacial times. He holds out a hope that we may yet meet with signs of man's existence in the pre-glacial forest-bed; but remarks that, even if found there, "pre-glacial man would scarcely date farther back than the commencement of the post-pliocene."

APPENDIX II.

The following table for the approximation of dates of tertiary and post-tertiary formations, is given in the hope of attracting attention to the subject, and of having the several dates compared with the existing strata of those periods. The table is a mere rough approximation, and will require much adjustment before the several dates shall have been so firmly determined as to form a reliable scale. Perhaps the progress

of geological discovery is not as yet sufficient to allow of placing those dates in perfect accordance with their corresponding strata.

TABLE OF APPROXIMATE GEOLOGICAL DATES FOR THE LAST
MILLION OF YEARS, SUGGESTED FOR RE-ADJUSTMENT.

	Years.		Years.
Lower miocene, from	1,000,000	to	825,000
Upper miocene, „	825,000	to	675,000
Pliocene, „	675,000	to	350,000
Post-pliocene, „	350,000	to	50,000
Recent, „	50,000	to	4,004 B.C.
Current, „	4,004 B.C.	to the present time.	

Several thousand years of libration may be allowed between the groups of strata in the foregoing table, as they, doubtless, blended gradually into each other.

It is fervently hoped that the subject may be followed up by competent parties, not only for the last million of years, but as much farther back into the ages past as further astronomical research will enable them to penetrate.

APPENDIX III.

The period of the revolution of the equinoxes relatively to the axis major of the earth's orbit, divided into two, is called "*the great summer and winter*," each of which, according to Adhemar, continues for 10,500 years.

During the whole of this period (except when the line of the equinoxes coincide with the axis major of the earth's orbit), one of the poles has shorter winters and longer summers than the other. It follows that, during a high eccentricity of the

earth's orbit, the pole that submits to the "*long winters*" undergoes a long continuous cooling, in consequence of which, the quantities of snow and ice which melt during the summer, are more than compensated by that which is again produced in the winter.

The snow and ice continue to accumulate from year to year, and eventually form, at the coldest pole, a crust or cap, voluminous, thick, and heavy enough to modify "the spheroidal form of the earth." The inference he draws from this is, that a notable displacement of the centre of gravity is produced (or of the centre of attraction). It has also been inferred that the change of the centre of gravity caused the submergence, by the waters accruing from the melted snow and ice of the southern pole flowing toward the north, and overwhelming the continents of the northern hemisphere.*

I have ventured to suggest that the submergence was caused by the contraction of the plastic clays and rocks, during the intense cold of the glacial epoch : may not each of those causes have had an effect, and the submergence have been the result of their combined operations?

The "*Great Year*" might properly be divided into four parts, analogous to our four seasons. In the passing of one pole into the "*summer*" division, and the other into the "*winter*," the change must have been gradual, and tempered, just as our changes are, by the intervention of what might be called "*spring*" and "*autumn*." The "*long winter*" period of accumulation of snow and ice at either pole, would not, therefore, continue to the full extent of the 10,500 years, but be qualified by a milder temperature on the approach of the summer period.

This great cycle of 21,000 years depends upon two others : one of 25,868 years, relating to the precession of the equinoxes ; the other, resulting from the position of the major axis of the earth's orbit shifting with a slow angular movement, which (if uniformly continued) would be carried round the whole circle of the ecliptic in 109,830 years.† Two of these great cycles are included within that of the 516,000 years of Mr. Gresswell (mentioned in the first chapter). They had at

* Adhemar, quoted by Wake.

† Sir J. Herschel's "Outlines of Astronomy," p. 235.

that time taken their departure from the zero point of the vernal equinox, and, after that long period, had again returned to the same point, in the year 4004 B.C.

The return of these cycles to the same node (about the time of the creation of Adam), has been confirmed by Sir John Herschell, when he states, "that in consequence of the joint variations in the time of the precession of the equinoxes and that of the perihelion, and of their receding from each other, the place of the perihelion must have coincided with the vernal equinox (or, in other words, have been situated in longitude 0°) *about four thousand years before the Christian era.*"

It may be observed that the cycle of 516,000 years would carry us back to about the middle of the pliocene period—a time posterior to the creation of "the beasts of the field;" to a time and a formation in which we should expect to find proofs of the presence of palæolithic man, should it hereafter be decidedly proved, from further discoveries, that man had a pre-glacial existence.

THE END.

THE DIAGRAM

OF

FOUR MILLIONS OF YEARS.

A WORK lately published on Pre-Glacial Man, contained a diagram showing the varying eccentricity of the earth's orbit for one million of years. I have, since that publication, received additional tables, showing the range of eccentricity for two millions of years further back of the past, and for one million of years of the future time as computed by Mr. Croll on Leverrier's formula. These tables involve long columns of figures. In meeting such an array, the inclination of the general reader is to turn over the leaf and merely look to results. To simplify the subject and enable the eye to observe more easily the several maxima and minima of the eccentricities, without wading through a mass of figures, I have prepared and annexed a diagram embracing the four millions of years on one sheet. In examining the diagram, bear in mind that principle of attraction which is inherent in matter; how, and with what power the sun and all planetary

bodies act and re-act upon each other, according to their respective size, density, and relative position. Take the action of the sun and moon upon the tides as a familiar example.

The effect of these complicated forces acting upon the earth's orbit, may be so small from century to century as to be almost unappreciable, but so great in a few thousand years as to engage attention. The elongation of the eccentricity of the earth's orbit has a maximum, a little over fourteen millions of miles, and a minimum slightly exceeding half a million.

To some the diagram may convey an erroneous impression without further explanation.

The difference between the elliptic figure of the orbit of the earth and that of a circle is, at times, comparatively so little as to render it hardly distinguishable on a small scale. Each grade of time on the diagram represents a period of 50,000 years; and as the equinoctial points would have made more than two revolutions round the ecliptic within that time, it was useless to attempt to portray the eccentricities of the orbit for 3,000,000 of years in a series of ever varying elliptical figures, an expedient was resorted to of representing the earth as moving along in a continuous horizontal line, and of showing the maxima and minima of the eccentricities above such line, giving their distances on an exaggerated scale. Lines were drawn from each grade of distance to the next, so as to

render the extent of eccentricity more apparent to the eye.

In looking at the eccentric movements as appearing on the diagram, they seem grouped in cycles, extending from 300 to 350 thousand years each, and that three of those groups are contained within each million of years. During the million last past, you will observe one of the eccentric oscillations embracing almost the whole of the post-pliocene time; a second group of but moderate elongation of orbit precedes it. The third contains three ranges of greater eccentricity. The upper miocene has been conjectured to be within this group. For the commencement of the miocene and the termination of the eocene, we may consequently look to the diagram of the preceding or second million of years.

It will remain for geologists to ascertain the time at which these two (the miocene and eocene) blended together. The amalgamation was most likely very gradual, and may have occupied an era of considerable extent. The great leading feature of the eocene period was the production of the nummulitic rocks. The eocene and miocene were, on an average, warm periods; yet, just as evidences of ice action were found in the miocene (as stated in "Preglacial Man"), so have traces of its existence been manifested in the eocene.* Large blocks of limestone are found enclosed in the strata of this formation, some regular, others

* "Lyell's Principles," vol. i., page 209.

rounded. Of these blocks some contain ammonites, and other fossils of the secondary formations (such as of the oolitic and liassic); some are of a variety of granite of a peculiar formation unknown in situ. In several places the blocks are 10 feet long, but near the lake of Thun are several of an enormous size, one 105 feet in length, 90 feet in breadth, and 145 feet in height, the edges rounded off either by decomposition or friction. Lyell observes, "It has been objected to the hypothesis of their having been transported to their present sites by glaciers, or by floating ice, that the eocene strata of nummulitic age contain genera of fossil plants and animals characteristic of a warm climate." He adds: "To imagine icebergs carrying such huge fragments of stone in so southern a latitude, and at a period immediately preceded and followed by signs of a warm climate, is one of the most perplexing enigmas which the geologist has yet been called upon to solve." The same difficulty presented itself with respect to the miocene period, but a glance at the diagram will show that such results are quite in accordance with astronomical facts. There were, in the times of the upper miocene, two eras of extreme eccentricity, one of $10\frac{1}{2}$ and the other of $13\frac{1}{2}$ millions of miles, these within a short time of each other (that is comparatively short), viz., one hundred thousand years. The next previous period of extreme range of eccentricity was separated by more than one million and a half of years. On examin-

ing the diagram of the four millions of years, an extraordinary coincidence is manifest as to the periodic times of the eccentric movements of the earth's orbit. These eccentricities are not chance wanderings, but are governed by fixed laws, and occur in regular sequence, in cycles of vast, but defined intervals. It has been already observed that from the diagram the movements have the appearance of having been projected in ranges or groups of three maxima and minima, each group containing from three hundred thousand to three hundred and fifty thousand years. The periods of duration in each group being so nearly equal, prove that the eccentricities were produced by similar operations of the like planetary forces, acting within given times, yet the extremes of maxima were very different ; some were so low as five and six millions ; others extended to ten, eleven, twelve, and, in one case, even to $13\frac{1}{2}$ millions of miles ; but little short of the estimated extreme bounds of the eccentricity of the earth's orbit.

Three of the four maxima appear strikingly alike on the diagrams, and have probably been periods of intense cold, intercalated by ages of extreme heat.

The post pliocene glacial epoch was different—the maxima were not so great as those of the three other epochs of glaciality, but the intercalations of minima were so slight as to leave the cold in excess and probably the accumulated snows of the very

prolonged winters of the Northern hemisphere when in Aphelion, unmelted by the summer's sun.

As to the importance of his tables, Mr. Croll observes:—"It is evident that 3,000,000 of years must stretch a considerable distance back into the geological history of our globe. *If geological climate depends upon, or is much affected by, the condition of the earth's orbit as regards eccentricity*, we have in this table combined with the other three the means by which a rough idea of the character of the climate, during at least a considerable portion of the tertiary period, may be arrived at."

Mr. Croll states it hypothetically. But supposing it to be proved that the glacial epochs were produced by the eccentricity, you will, by means of those tables, be able to discover and apply several dates, viz.:—The time of the waning of the post-pliocene, the commencement of the recent period, and the time of the last glacial epoch. You can mark the extent of the pliocene period, and ascertain the dates of the upper miocene; you can discover that in the midst of its warmth there occurred an era of intense cold; and you can place its culmination at 850,000 years of by-gone time.

The middle eocene you can ascertain to have occurred 2,500,000 years ago, and where, from evidences of the fossils, we should have expected to find a tropical climate in high northern regions, the diagram shews the interposition of two periods

of great glaciality, the earth's orbit having reached in one of them an eccentricity of 13,000,000 of miles.

Astronomy has lent its valuable and effective aid, and has given a clue to the solution of the difficulty. In marking the dates of those great eccentricities, it has given certain fixed data for calculating geological periods of time. Geologists should follow up the subject, and give the names and forms of those existences which prevailed as well during the extended periods of fervid heat as of blighting cold. It is suggested that much may be done in a simple and inexpensive manner.

If erratic rocks, or stones found in strata to which they do not belong, were carefully examined, their situations, striations, and roundings noted; the formations from whence they were detached, and their distance from the parent rocks observed—if these particulars, collected from time to time, were transmitted to some eminent person in each of the three countries, England, Ireland and Scotland—if the proprietors and captains of mines were requested to make similar observations, and to communicate the results to the same parties, a fund of information would be thus accumulated, and a store of facts laid up, available, some for present, others for future use. By these means, a system or outline of Geological Chronology might be constructed. This (as new facts were from time to time discovered) might be tested,

corrected, and ultimately perfected. Who can doubt that these warm and cold cycles have been in operation, even before the commencement of the earliest formations now known upon the earth's surface? Look at those diagrams for the four millions of years, and observe the striking indications of the periodical recurrence of those warm and cold cycles according to some invariable law. The minor oscillations of each group appear to be limited in their ranges to from 300,000 to 350,000 years, whilst the great maxima and minima, or the Grand Cycles do not re-appear until the expiration of more than one million-and-a-half of years. By carrying these movements back mentally to the formation of the earliest strata of the earth's surface, some slight idea may be formed of the vast cycles in which glacial epochs have been reproduced. Look at those three great maxima indicated on the diagram: that of the middle eocene, that of the upper miocene, and that at the end of the current million of years, whose effects are yet to come, and it will be obvious that they are but smaller portions of one great and settled plan, cycle within cycle, which the Almighty has ordained from the beginning of time. Lyell has found evidence of ice action in the chalk formation, also in the oolitic, and in the triassic. He does not mention any in the Carboniferous formations. Among those, great opportunities exist for examination. That indications of such action may be found there if sought

for is most likely. Proprietors of extensive coal mines have informed me that in the centre of coal beds large boulder stones have been found, some of granite, some of trap, or of other formations, that frequently fossil shells have been found in the roofs and floors of the coal measures at depths of several hundred feet. Sometimes the shells were of fresh water production, at others of marine. In those coal beds you have proofs of rank and luxuriant vegetable growth, during an era of a warm and steamy atmosphere. In the erratic boulders, embedded in the coal, you have most probably traces of ice action; and in the fossils, proof of long-continued depression of the land beneath the sea as well as under fresh water. The succeeding beds of coal and of alternating rocks, clays, and drift, would suggest the recurrence of glacial epochs, reciprocating with warm cycles. How many of these must have succeeded each other during the formation of the coal fields near* the river Ruhr in Prussia, on the lower Rhine. Sixty-five separate strata of coal have been there penetrated, each more than twenty inches thick. Ages must have rolled away whilst the vegetation of each of these seams was beginning, growing, decaying, and becoming condensed into coal. Epoch must have succeeded epoch whilst these sixty-five several seams were being formed and separated from each other by sixty-five distinct formations of rock and clay.

* "Year Book of Facts," 1869, p. 213.

There may have been many subsidences and re-emergences of the land, many periods of ice action, of drift and moraine, of deposits of sand, clay, and shingle, alternating with the vegetable growth of those sixty-five beds of coal.

Assuming that geological climate depends upon and is influenced by the eccentricity of the earth's orbit, the important bearing of Mr. Croll's tables may be thus shortly recapitulated.

The earth having been at times several millions of miles more distant from the sun than at other periods, those varying distances gave rise to a succession of warm and cold cycles. No application of that knowledge has been hitherto made to geological purposes. Geologists found abundant traces of one glacial epoch ; they found also evidence of others, but the times at which those had occurred were utterly unknown. Within the tertiary strata, indications were found of three great periods of excessive cold ; but how many years since those had taken place could not then be guessed at with any degree of probability. Tables showing the eccentricity of the earth's orbit were calculated back for one million of years. From these it appeared that the last great glacial epoch culminated 210 thousand years ago. Tables of the eccentricity have been continued for two millions of years further back. Mr. Croll has suggested that the chief glacial epoch of the miocene occurred 850 thousand years, and that of the middle eocene two millions 500

thousand years ago. The dates and times of these three great astronomical eccentricities appear to correspond with the traces of ice action, previously announced by Lyell to have been found in the post-pliocene, in the upper miocene, and middle eocene formations. An approximate advance has been so far made in geological chronology, embracing three millions of years.

Palæontology can be now connected with these dates from an examination of the fossil remains found in those three great formations. Thus, the remains of palæotheres, glyptodons, &c., being found in the Eocene ; the dates of the existence of those animals may be referred to the time of the third million of years.

The Dinotherii, Sivatherii, Crocodiles, and gigantic Tortoises, &c., may be deemed to have existed in the second million of years back ; the Mammoth and Mastodon, *Elephas Antiquus*, Musk Ox, and others, flourished within the miocene, pliocene, and early part of the post-pliocene ages ; or, in point of date, in the early and middle part of the last million of years.

Another connection with dates and times can be made which to many persons will appear the most important of all, viz.—The reconciliation of these dates with the Mosaic record. Moses described what he probably may have seen in six short visions of the six great days or periods of creation. He detailed the order of succession of the

creation of the upheaval of the land, and gathering together of the waters; of the first appearance of fish and of fowl, of the growth of herb and tree, of the production of vegetable and animal life, as presented to his view. Geological investigation has confirmed the accuracy of his description of the successional developments contained in that record, but the measure of the length of those days remained unascertained. Moses had written that "cattle, and creeping things, and beasts of the earth" were created on the sixth day of the hexaëmeron. Geologists find their remains in the eocene and in subsequent deposits. If the date of the commencement of the eocene (as shown in the diagram) extended back beyond the 3,000,000 of years, it is obvious that the sixth day of the hexaëmeron must have commenced before that time.

The Mosaic record agrees with geological discoveries, and these, with astronomical calculations. Thus they confirm each other. Moses has announced that man was made on the same day with the living creature, with cattle and the creeping thing, and beasts of the earth. On the sixth day, "Male and female created he them." Remains or indications of man are found in juxta position with races of animals which existed before the last great glacial period—that epoch culminated 210,000 years ago; therefore the fair conclusion is, that mankind may have been on the earth at that part of the sixth day; that Adam was made on the evening of the

same day, but at a later period. He was the crowning work of the creation—the first into whose nostrils God breathed the breath of spiritual life, and who first became a living soul.*

The length or duration of the sixth day, as well as the times or dates of the formations of the several strata of the earth's crusts within the tertiary period, having been approximately placed for the 3,000,000 of years of bye-gone time, it remains for geologists to test these evidences accurately, and by correcting them by facts to be observed in future, to convert the approximate table of dates into an ascertained and established system of geological chronology.

ADDITIONAL TABLE

Of approximate dates for the 2,000,000 of years prior to that given in APPENDIX No. 2 of Preglacial Man:—

Middle eocene from 3,000,000 of years to 2,000,000 of years.

Upper eocene from 2,000,000 of years to 1,500,000 years.

Lower and middle miocene from 1,500,000 to 1,000,000 years.

As the former table was only suggested for re-ad-

* "In Adam and the Adamites" this view is ably sustained by Mr. M'Causland. See also the "Genesis of the Earth and Man," edited by Reignald Stuart Poole, of the British Museum.

justment, so is the present also for correction, when, and as, new facts may in future be unfolded.

The middle eocene is given above as commencing at 3,000,000 of years, the extent of the present diagram.

These calculations can only be received as provisional for the present. Before they can be relied on, it would be essential that the question : “ How far geological climate depends upon, or is affected by, the earth’s orbit as regards eccentricity ? ” should be fully investigated and determined by competent authority.

ADAM 4004 B. C.	50 thousand years. before A. D. 1800.	1.
900		N.
950	1 Million of Years after A. D. 1800.	

THE MOSAIC RECORD.

SIXTH DAY OF THE HEXAËMERON.

1st c. . Genesis—24 v

“AND GOD SAID :

“LET THE EARTH BRING FORTH

THE LIVING CREATURE

AFTER HIS KIND,

CATTLE,

AND CREEPING THING,

AND BEAST OF THE EARTH,

AFTER HIS KIND ;’

AND IT WAS SO.”

26 v .

“AND GOD SAID :

“LET US MAKE MAN,” &c.

* * * *

MALE AND FEMALE,

CREATED HE THEM.

PART OF THE SIXTH DAY OF THE HEXAËMERON.

Three Millions of Years before the Year A. D. 1800.

3 Millions of Years
before A. D. 1800.
2 Millions 950 thousand years

Some of the Fossil Fauna of the Eocene.

Glyptodons, Anoplothors, Charopotami, Palæothors,
and others.

Birds,

Reptiles,

Nummulites,

Sands,

Gypsum,

Clays, &c., &c.

11
10
9
8
7
6
5
4
3
2
1

MIDDLE EOCENE

PART OF THE SIXTH DAY.

Two Millions of Years before the Year A. D. 1800.

2 Millions of Years
before A. D. 1800.
1 Million 950 thousand years

Some of the Fossil Fauna of the Miocene.

Dimothers, and several of the Proboscidian

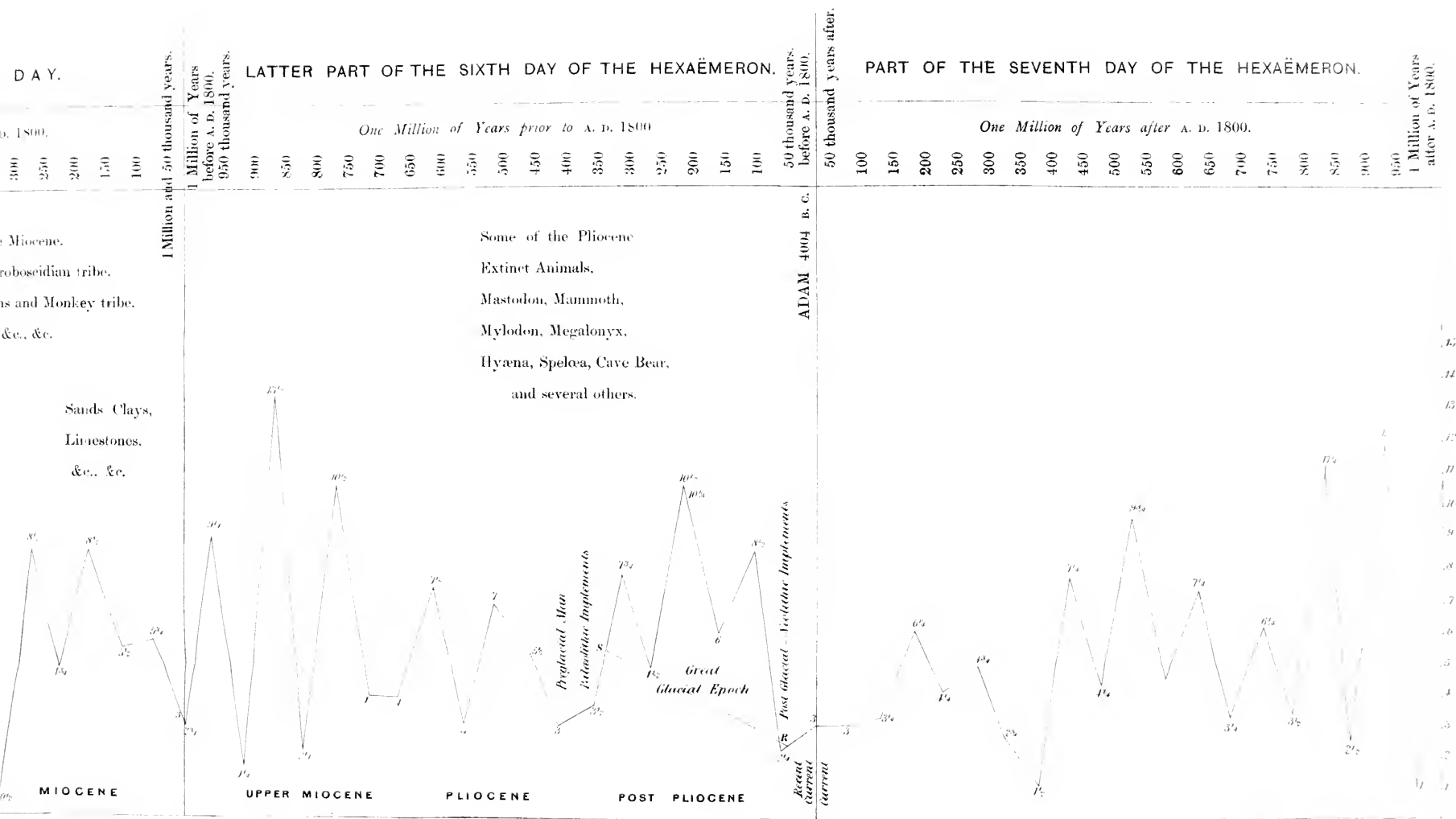
Sivatherii Hippopotami, Gibbons and Monks

Crocodiles, Gigantic Tortoises, &c., &c.

11
10
9
8
7
6
5
4
3
2
1

EOCENE

MIOC

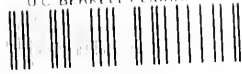


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